

**REMEDIATION SYSTEM INSTALLATION SUMMARY REPORT  
POLLOCK STREET SEWER OUTFALL**

**SUNOCO, INC (R&M)  
PHILADELPHIA REFINERY  
PHILADELPHIA, PA**

**June 2012**



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## 1.0 INTRODUCTION

The subject of this report includes the investigation and remediation of a light non-aqueous phase liquid (LNAPL) discharge to the Schuylkill River at the area where the Pollock Street Sewer discharges to the river within Area of Interest 2 (AOI-2) at the Sunoco Philadelphia Refinery. **Figure 1** illustrates the location of the sewer within the refinery.

In October 2011, LNAPL was observed within the Pollock Street Sewer Outfall, hereto referred to as “Outfall”, entering into the Schuylkill River. This observation prompted immediate action by Sunoco to determine the source of the LNAPL, stop the discharge, and implement appropriate remedial activities. This report provides a summary of the activities completed by Sunoco to address this LNAPL release.

## 2.0 INVESTIGATION ACTIVITIES

### 2.1 Sewer Video Inspection

GE Inspection Technologies, LP (GEIT) was contracted by Aquaterra and Sunoco to perform an internal inspection of the Pollock Street sewer. GEIT utilized a Rovver® robotic crawler outfitted with a pan-and-tilt color video camera for remote visual inspection. Aquaterra provided direction of the inspection, field oversight, and review of the video. Video activities were performed as two separate events. The first event commenced on November 22, 2011 and was completed on December 19, 2011. The second event commenced on May 29, 2012 and was completed on June 8, 2012.

The sewer, which was constructed in the 1920's, is a 12' x 8' concrete combined storm water/wastewater sewer (CSO) with a trapezoidal shaped bottom. There are joints every 22 feet. The sewer runs in an East-West orientation through the facility. There are 12 manholes between the interceptor chamber at 26<sup>th</sup> Street and the outfall at the Schuylkill River. Inspection segments between each of the manholes are noted as “MH1-MH2”, etc. These designations are reversed at times in the summary below, which means that the inspection process began at a higher numbered manhole, and was performed in an upstream orientation.

During the visual inspection and video review of the sewer, notations of infiltration by water, potential oil, mineralization, and quality of water surface were noted in the observation log. A summary of the video observations are provided on **Figures 2 and 3**. Notes taken during the video inspections are contained in **Appendix A**.

### 2.2 Line Excavation and Repair

Two lines, FOM/ Barge Line and the APL 4 transfer products in the vicinity of the Pollock Street sewer, River Road and the Schuylkill River. The FOM/Barge Line transfers Light Cycle Oil to and from the refinery as a saleable product or a feed stock. The APL 4 Line transfers finished jet fuel, kerosene and diesel from No. 4 Tank Farm to the APL 4 and 5 pipelines outbound from the refinery. Both of these lines run above grade on either side of River Road and then through a 48 inch steel conduit beneath River Road, as shown on Figure 5.

The FOM/Barge line is pressure tested annually per USCG requirements. The APL 4 is not routinely tested as the line is in constant service and visual inspection of the line demonstrates line integrity

The FOM/Barge line passed a pressure test on November 10, 2010. It was tested on November 15, 2011 and failed the pressure testing. Immediately after the November 15, 2011 test of the FOM/Barge line failed, the line was taken out of service and made inoperable by locking out the valves. The line was uncovered on both sides of the road to make repairs. Refinery Maintenance removed the old pipe from under the road and fabricated a new spool. All components of the new line were hydrostatically tested individually and as an assembled unit prior to installation. The new spool was installed December 5 and 6, 2011. The line was tested on December 7, 2011. The line passed pressure testing on December 7, 2011 and was returned to service on December 8, 2011.

Copies of the 2010 and 2011 FOM/Barge line pressure tests are included in Appendix B.

### **2.3 LNAPL Sampling and Results**

All monitoring wells adjacent to the sewer were gauged for water table elevations and LNAPL thicknesses in January and May 2012. **Tables 1** and **2** contain the gauging data for the January and May 2012 events, respectively. **Figures 4** and **5** show the location of monitoring wells and existing recovery systems, a cross section of the Pollock Street sewer and the extent/thickness of LNAPL adjacent to the sewer in January and May 2012, respectively. As demonstrated on the figures, the extent and magnitude of LNAPL adjacent to the sewer was greatly reduced between January and May 2012 due to repair of the FOM/Barge Line and the installation of the groundwater remediation system described in Section 3.

LNAPL samples were collected in February, March, April and May 2012 from select wells adjacent to the Pollock Street sewer for purposes of characterizing LNAPL plumes and identifying a source of oil in the sewer. Samples were run through a simulated distillation and analyzed for specific gravity, sulfur and bromine index. Results of LNAPL sampling results are included in Table 3.

The simulated distillation and specific gravity indicate the type of product i.e. crude oil, gas oil, finished products, etc. Sulfur results provide a good indicator of age of LNAPL, i.e. the lower the sulfur result the more recent the LNAPL. Bromine index value indicates the presence of cracked stocks such as Light Cycle Oil (LCO). Straight run distillate streams and hydro-treated streams have very low bromine values relative to LCO.

- Samples collected from wells near to the leak showed low bromine index numbers and low sulfur numbers indicating a recent release of LCO. This is a product expected from the FOM/Barge line.
- Samples secured from wells further east from River Road indicate an older release based on sulfur values.
- Samples secured from the outfall indicate a mixed stream based on varying sulfur results.

**Figures 6 and 7** show the sulfur plots for LNAPL samples secured in February and April respectively.

## **3.0 REMEDIATION ACTIVITIES**

### **3.1 Recovery Well Installation**

A total of 17 recovery wells (RW-113 through RW-129) were installed between December 2011 and March 2012 in the area adjacent to the Outfall, as shown on **Figure 8**. Wells were constructed of six-inch



diameter PVC (0.2" slotted screen and solid riser). Wells were typically completed to 30 feet total depth and each has a minimum of 15 feet of screen to intercept the top of the water table and any LNAPL present. The wells were installed via mud rotary drilling methods by Total Quality Drilling (TQD) of New Jersey.

### 3.2 System Installation

Two separate recovery areas, referred to as the Upper and Lower Systems were installed to address the LNAPL in the subsurface adjacent to the Pollock Street sewer.

The Upper System incorporated 10 existing wells that were in the area east of Schuylkill Avenue and on the north and south sides of the sewer. These wells include S-93, S-251 through S-254, and S-313 through S-317.

The Lower System incorporated seventeen newly installed recovery wells and three existing wells (RW-104 through RW-106) in the area west of Schuylkill Avenue on the north and south sides of the sewer. Recovery wells and system locations are illustrated on **Figure 8**.

At each of the recovery well locations, a 2' by 2' vault was installed around the well. Within select wells, a 4" pneumatic QED Environmental Systems AP4 pump was installed. Each well was tied into the system with either a 1 or 2 inch air hose for pump operation and either a 2 or 4 inch line for transfer of liquid to the treatment trailer. Currently, five wells are operational in the Upper System and seventeen wells are operational in the Lower System.

Within the treatment trailer all fluids are run through an oil-water separator. LNAPL is transferred to one of two recovery tanks situated outside the trailer. Water is transferred from the separator to the S-10 Sump located within the refinery. From the S-10 Sump, water transfers to the Point Breeze wastewater treatment plant (also referred to as the BioPlant). LNAPL collected in the recovery tanks is removed via vacuum truck on an as-needed basis and is recycled by the refinery. A treatment system diagram is included as **Figure 9**.

Operation of the Upper System began on February 15, 2012 and operation of the Lower System began on February 23, 2012. The combined upper and lower systems are referred to as the West End Remediation System. Prior to beginning operation of the West End Remediation System, all piping and associated connections were tested for tightness. Total fluids recovery information will be recorded, monitored and reported by Stantec personnel. As of June 15, 2012, the system has recovered 3,397,905 gallons of groundwater and 27,954 gallons of LNAPL.

#### 4.0 CONCLUSIONS AND RECOMMENDATIONS

Based on currently available information, the following conclusions can be drawn:

- The FOM/Barge line began leaking sometime between November 2010 and August 2011.
- A leak from the FOM line, discovered in November 2011 introduced new distillate product into the ground at the intersection of River Road and the Pollock Street sewer.
- Previous monitoring well gauging data indicates older distillate product, pre-existing this leak, was present in the ground adjacent to the Pollock Street sewer.
- The oil migrating into the sewer is a mixture of historic releases and the most recent FOM/Barge line release. As such, we don't expect to find a single current product stream that matches the composition of the oil in the outfall.
- Ten existing wells and seventeen new wells were tied together into a groundwater extraction system adjacent to the sewer. The system was brought on line on February 23, 2012. As of June 15, 2012, the system has recovered 3,397,905 gallons of groundwater and 27,954 gallons of LNAPL.
- The new oil recovery wells are drawing LNAPL from the location of the spill to the wells, mitigating the intrusion of oil into the sewer
- The volume of oil in the Pollock Street sewer outfall has been greatly reduced since operation of the groundwater extraction system began.
- The extent and magnitude of LNAPL in the ground adjacent to the Pollock Street sewer outfall has been significantly reduced.

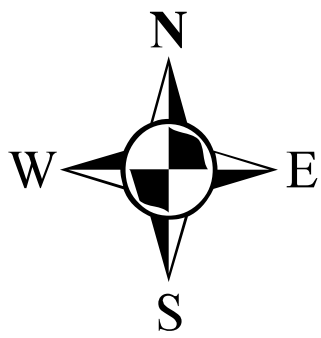
The following recommendations and plan are proposed to further address conditions in the area of outfall and the Pollock Street sewer;

- Five test pits will be performed in the Barrel Warehouse to determine extent and magnitude of LNAPL beneath the building.
- Two additional monitoring wells will be installed between manholes 5 and 6.
- Three additional monitoring wells will be installed in the vicinity of Joint 10 between Manholes 7 and 8.
- Three additional monitoring wells will be installed in the vicinity of Joints 1 and 2 between Manholes 8 and 9.
- **Figure 10** shows the locations of the test pits and proposed monitoring wells.

# **DRAWINGS**

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**Legend**

- Shallow Monitoring Well
- Intermediate Monitoring Well
- Deep Monitoring Well
- Shallow/Intermediate Monitoring Well
- Damaged/Destroyed/Unable to Locate
- Shallow Recovery Well
- Shallow/Intermediate Recovery Well
- Intermediate Recovery Well
- Piezometer
- Staff Gauge Location
- Monitoring Well Location
- Invert
- Manhole
- Pollock Street Sewer
- AOIs

Notes:  
1. Bing Maps Aerial basemap is provided through Langan's Esri ArcGIS software licensing and ArcGIS online © 2010 Microsoft Corporation and its data suppliers.

Figure 1: Site Plan  
Pollock Street Sewer  
Sunoco Philadelphia Refinery  
Philadelphia, Pennsylvania

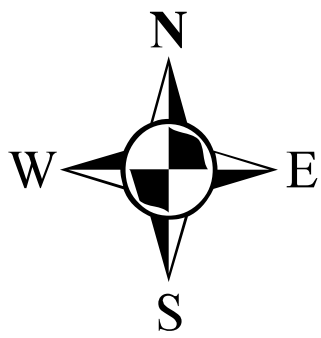


Sunoco, Inc. (R&M)  
Philadelphia Refinery  
3144 Passyunk Avenue  
Philadelphia, PA.  
19145

0 120 240  
Feet

SCALE: 1" = 120'  
DATE: May 17, 2012  
DWN BY: MM  
CKD BY: DW  
JOB#: 2674801





## Legend

- Shallow Monitoring Well
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- Invert
- Manhole
- Pollock Street Sewer
- AOIs
- Observation Points of Video Inspection
- 19 → 24 Camera Traveled West - East
- 42 ← 38 Camera Traveled East - West

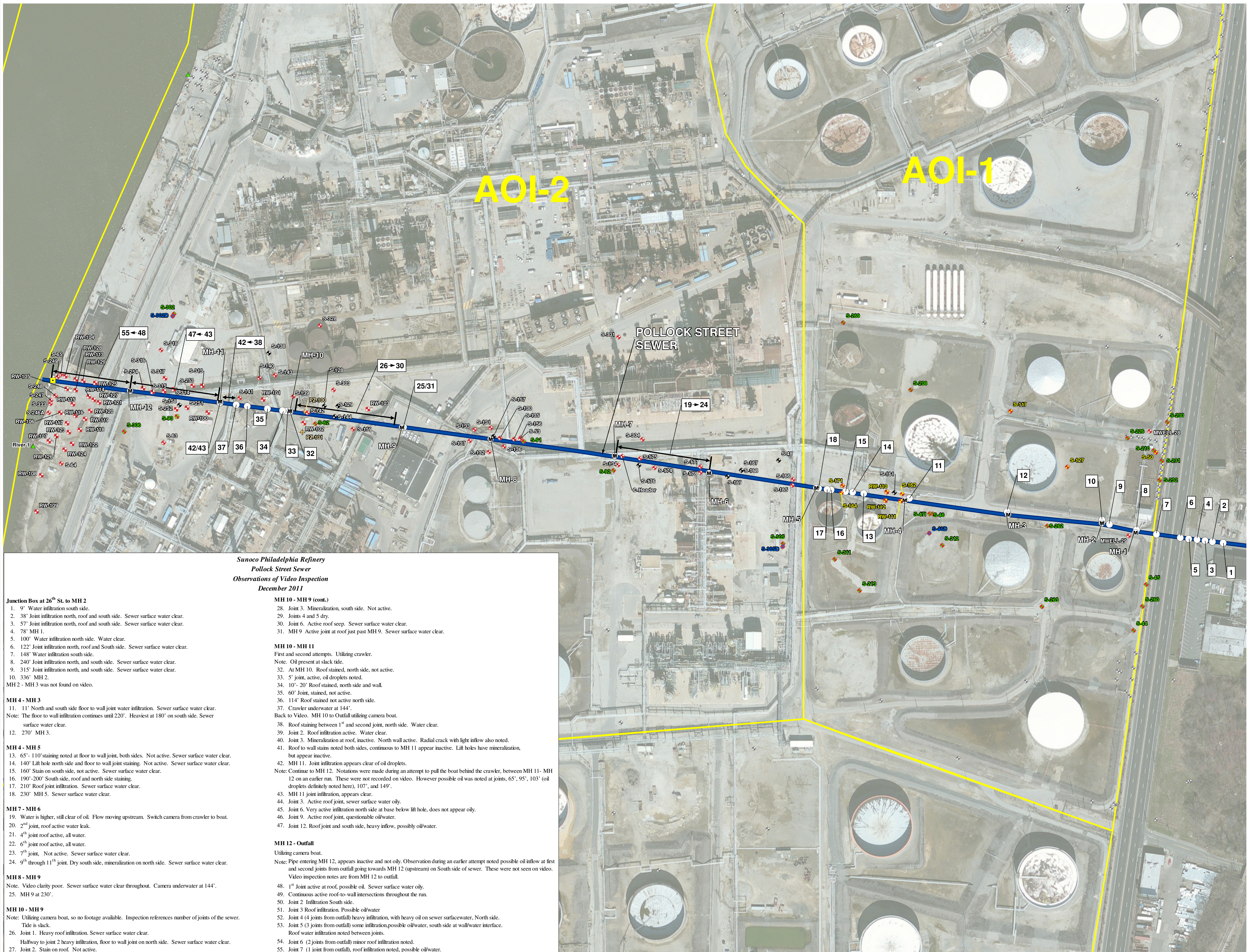
Notes:  
1. Bing Maps Aerial basemap is provided through Langan's Esri ArcGIS software licensing and ArcGIS online © 2010 Microsoft Corporation and its data suppliers.  
2. Observations within the Pollock Street Sewer from video inspection December 2011.

Figure 2: AOI 1 & AOI 2  
Pollock Street Sewer Observations  
December 2011  
Sunoco Philadelphia Refinery  
Philadelphia, Pennsylvania



0 120 240 Feet

SCALE: 1" = 120'  
DATE: May 17, 2012  
DWN BY: MM  
CKD BY: DW  
JOB#: 2074801



### Sunoco Philadelphia Refinery Pollock Street Sewer Observations of Video Inspection December 2011

**Junction Box at 26<sup>th</sup> St. to MH 2**  
1. 9" Water infiltration south side.  
2. 38" Joint infiltration north, roof and south side. Sewer surface water clear.  
3. 57" Joint infiltration north, roof and south side. Sewer surface water clear.  
4. 78" MH 1.  
5. 100' Water infiltration north side. Water clear.  
6. 122' Joint infiltration north, roof and South side. Sewer surface water clear.  
7. 148' Water infiltration south side.  
8. 240' Joint infiltration north, and south side. Sewer surface water clear.  
9. 315' Joint infiltration north, and south side. Sewer surface water clear.  
10. 336' MH 2.  
MH 2 - MH 3 was not found on video.

**MH 4 - MH 3**  
11. 11' North and south side floor to wall joint water infiltration. Sewer surface water clear.  
Note: The floor to wall infiltration continues until 220'. Heaviest at 180' on south side. Sewer surface water clear.  
12. 270' MH 3.

**MH 4 - MH 5**  
13. 65'-110' staining noted at floor to wall joint, both sides. Not active. Sewer surface water clear.  
14. 140' Lift hole north side and floor to wall joint staining. Not active. Sewer surface water clear.  
15. 160' Stain on south side, not active. Sewer surface water clear.  
16. 190'-200' South side, roof and north side staining.  
17. 210' Roof joint infiltration. Sewer surface water clear.  
18. 230' MH 5. Sewer surface water clear.

**MH 7 - MH 6**  
19. Water is higher, still clear of oil. Flow moving upstream. Switch camera from crawler to boat.  
20. 2<sup>nd</sup> joint, roof active water leak.  
21. 4<sup>th</sup> joint roof active, all water.  
22. 6<sup>th</sup> joint roof active, all water.  
23. 7<sup>th</sup> joint. Not active. Sewer surface water clear.  
24. 9<sup>th</sup> through 11<sup>th</sup> joint. Dry south side, mineralization on north side. Sewer surface water clear.

**MH 8 - MH 9**  
Note: Video clarity poor. Sewer surface water clear throughout. Camera underwater at 144'.  
25. MH 9 at 230'.

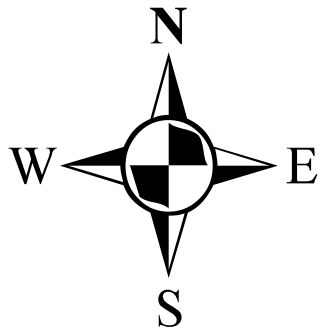
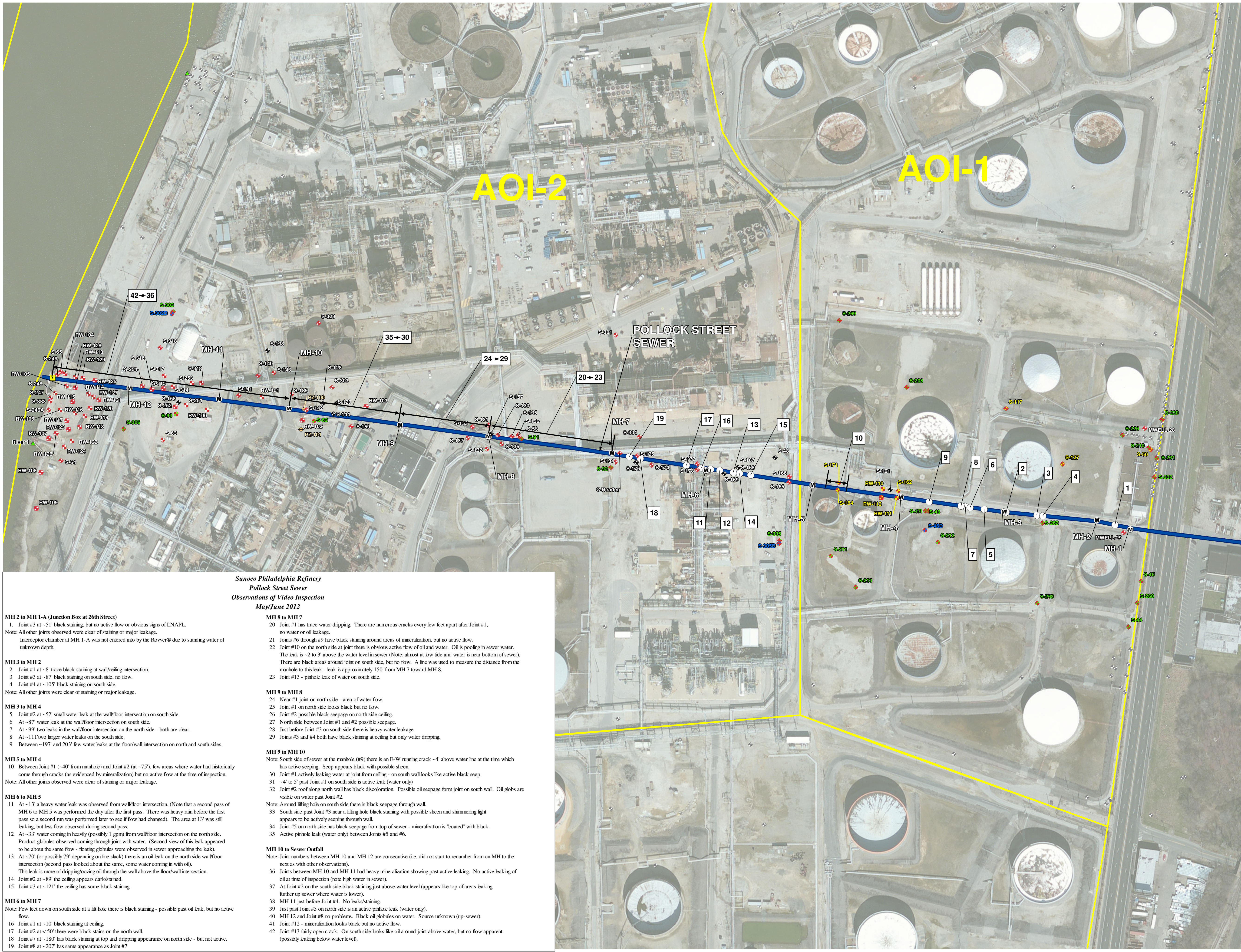
**MH 10 - MH 9**  
Note: Utilizing camera boat, so no footage available. Inspection references number of joints of the sewer.  
Tide is slack.  
26. Joint 1. Heavy roof infiltration. Sewer surface water clear.  
Halfway to joint 2 heavy infiltration, floor to wall joint on north side. Sewer surface water clear.  
27. Joint 2. Stain on roof. Not active.

**MH 10 - MH 9 (cont.)**  
28. Joint 3. Mineralization, south side. Not active.  
29. Joints 4 and 5 dry.  
30. Joint 6. Active roof seep. Sewer surface water clear.  
31. MH 9 Active joint at roof just past MH 9. Sewer surface water clear.

**MH 10 - MH 11**  
First and second attempts. Utilizing crawler.  
Note: Oil present at slack tide.  
32. At MH 10. Roof stained, north side, not active.  
33. 5' joint, active, oil droplets noted.  
34. 10'-20' Roof stained, north side and wall.  
35. 60' Joint, stained, not active.  
36. 114' Roof stained not active north side.  
37. Crawler underwater at 144'.  
Back to Video. MH 10 to Outfall utilizing camera boat.  
38. Roof staining between 1<sup>st</sup> and second joint, north side. Water clear.  
39. Joint 2. Roof infiltration active. Water clear.  
40. Joint 3. Mineralization at roof, inactive. North wall active. Radial crack with light inflow also noted.  
41. Roof to wall stains noted both sides, continuous to MH 11 appear inactive. Lift holes have mineralization, but appear inactive.  
42. MH 11. Joint infiltration appears clear of oil droplets.  
Note: Continue to MH 12. Notations were made during an attempt to pull the boat behind the crawler, between MH 11- MH 12 on an earlier run. These were not recorded on video. However possible oil was noted at joints, 65', 95', 103' (oil droplets definitely noted here), 107', and 149'.  
43. MH 11 joint infiltration, appears clear.  
44. Joint 3. Active roof joint, sewer surface water oily.  
45. Joint 6. Very active infiltration north side at base below lift hole, does not appear oily.  
46. Joint 9. Active roof joint, questionable oil/water.  
47. Joint 12. Roof joint and south side, heavy inflow, possibly oil/water.

**MH 12 - Outfall**  
Utilizing camera boat.  
Note: Pipe entering MH 12, appears inactive and not oily. Observation during an earlier attempt noted possible oil inflow at first and second joints from outfall going towards MH 12 (upstream) on South side of sewer. These were not seen on video. Video inspection notes are from MH 12 to outfall.  
48. 1<sup>st</sup> Joint active at roof, possible oil. Sewer surface water oily.  
49. Continuous active roof-to-wall intersections throughout the run.  
50. Joint 2 Infiltration South side.  
51. Joint 3 Roof infiltration. Possible oil/water  
52. Joint 4 (4 joints from outfall) heavy infiltration, with heavy oil on sewer surfacewater, North side.  
53. Joint 5 (3 joints from outfall) some infiltration, possible oil/water, south side at wall/water interface. Roof water infiltration noted between joints.  
54. Joint 6 (2 joints from outfall) minor roof infiltration noted.  
55. Joint 7 (1 joint from outfall), roof infiltration noted, possible oil/water.





## Legend

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### Sunoco Philadelphia Refinery Pollock Street Sewer Observations of Video Inspection May/June 2012

**MH 2 to MH 1-A (Junction Box at 26th Street)**

- Joint #3 at ~51' black staining, but no active flow or obvious signs of LNAPL.

Note: All other joints observed were clear of staining or major leakage.  
Interceptor chamber at MH 1-A was not entered into by the Rovver® due to standing water of unknown depth.

**MH 3 to MH 2**

- Joint #1 at ~8' trace black staining at wall/ceiling intersection.
- Joint #3 at ~87' black staining on south side, no flow.
- Joint #4 at ~105' black staining on south side.

Note: All other joints were clear of staining or major leakage.

**MH 3 to MH 4**

- Joint #2 at ~52' small water leak at the wall/floor intersection on south side.
- At ~87' water leak at the wall/floor intersection on south side.
- At ~99' two leaks in the wall/floor intersection on the north side - both are clear.
- At ~111' two larger water leaks on the south side.
- Between ~197 and 203' few water leaks at the floor/wall intersection on north and south sides.

**MH 5 to MH 4**

- Between Joint #1 (~40' from manhole) and Joint #2 (at ~75'), few areas where water had historically come through cracks (as evidenced by mineralization) but no active flow at the time of inspection.

Note: All other joints observed were clear of staining or major leakage.

**MH 6 to MH 5**

- At ~13' a heavy water leak was observed from wall/floor intersection. (Note that a second pass of MH 6 to MH 5 was performed the day after the first pass. There was heavy rain before the first pass so a second run was performed later to see if flow had changed). The area at 13' was still leaking, but less flow observed during second pass.
- At ~33' water coming in heavily (possibly 1 gpm) from wall/floor intersection on the north side. Product globules observed coming through joint with water. (Second view of this leak appeared to be about the same flow - floating globules were observed in sewer approaching the leak).
- At ~70' (or possibly 79' depending on line slack) there is an oil leak on the north side wall/floor intersection (second pass looked about the same, some water coming in with oil). This leak is more of dripping/oozing oil through the wall above the floor/wall intersection.
- Joint #2 at ~89' the ceiling appears dark/stained.
- Joint #3 at ~121' the ceiling has some black staining.

**MH 6 to MH 7**

Note: Few feet down on south side at a lift hole there is black staining - possible past oil leak, but no active flow.

- Joint #1 at ~10' black staining at ceiling.
- Joint #2 at < 50' there were black stains on the north wall.
- Joint #7 at ~180' has black staining at top and dripping appearance on north side - but not active.
- Joint #8 at ~207' had same appearance as Joint #7

**MH 8 to MH 7**

- Joint #1 has trace water dripping. There are numerous cracks every few feet apart after Joint #1, no water or oil leakage.
- Joints #6 through #9 have black staining around areas of mineralization, but no active flow.
- Joint #10 on the north side at joint there is obvious active flow of oil and water. Oil is pooling in sewer water. The leak is ~2 to 3' above the water level in sewer (Note: almost at low tide and water is near bottom of sewer). There are black areas around joint on south side, but no flow. A line was used to measure the distance from the manhole to this leak - leak is approximately 150' from MH 7 toward MH 8.
- Joint #13 - pinhole leak of water on south side.

**MH 9 to MH 8**

- Near #1 joint on north side - area of water flow.
- Joint #1 on north side looks black but no flow.
- Joint #2 possible black seepage on north side ceiling.
- North side between Joint #1 and #2 possible seepage.
- Just before Joint #3 on south side there is heavy water leakage.
- Joints #3 and #4 both have black staining at ceiling but only water dripping.

**MH 9 to MH 10**

Note: South side of sewer at the manhole (#9) there is an E-W running crack ~4' above water line at the time which has active seeping. Seep appears black with possible sheen.

- Joint #1 actively leaking water at joint from ceiling - on south wall looks like active black seep.
- ~4' to 5' past Joint #1 on south side is active leak (water only)
- Joint #2 roof along north wall has black discoloration. Possible oil seepage form joint on south wall. Oil globs are visible on water past Joint #2.

Note: Around lifting hole on south side there is black seepage through wall.

- South side past Joint #3 near a lifting hole black staining with possible sheen and shimmering light appears to be actively seeping through wall.
- Joint #5 on north side has black seepage from top of sewer - mineralization is "coated" with black.
- Active pinhole leak (water only) between Joints #5 and #6.

**MH 10 to Sewer Outfall**

Note: Joint numbers between MH 10 and MH 12 are consecutive (i.e. did not start to renumber from on MH to the next as with other observations).

- Joints between MH 10 and MH 11 had heavy mineralization showing past active leaking. No active leaking of oil at time of inspection (note high water in sewer).
- At Joint #2 on the south side black staining just above water level (appears like top of areas leaking further up sewer where water is lower).
- MH 11 just before Joint #4. No leaks/staining.
- Just past Joint #5 on north side is an active pinhole leak (water only).
- MH 12 and Joint #8 no problems. Black oil globules on water. Source unknown (up-sewer).
- Joint #12 - mineralization looks black but no active flow.
- Joint #13 fairly open crack. On south side looks like oil around joint above water, but no flow apparent (possibly leaking below water level).

Notes:  
1. Bing Maps Aerial basemap is provided through Langan's Esri ArcGIS software licensing and ArcGIS online © 2010 Microsoft Corporation and its data suppliers.  
2. Observations within the Pollock Street Sewer from video inspection May/June 2012.

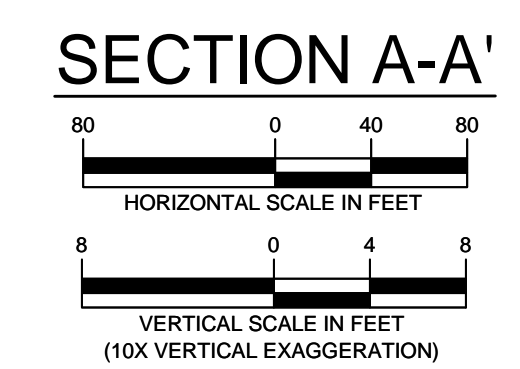
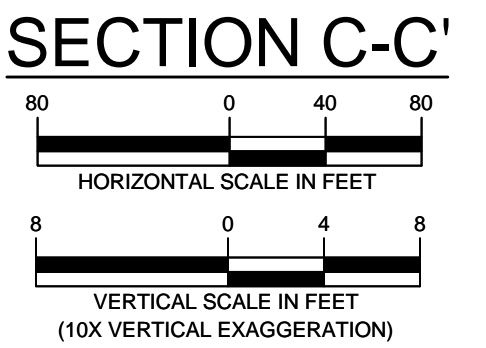
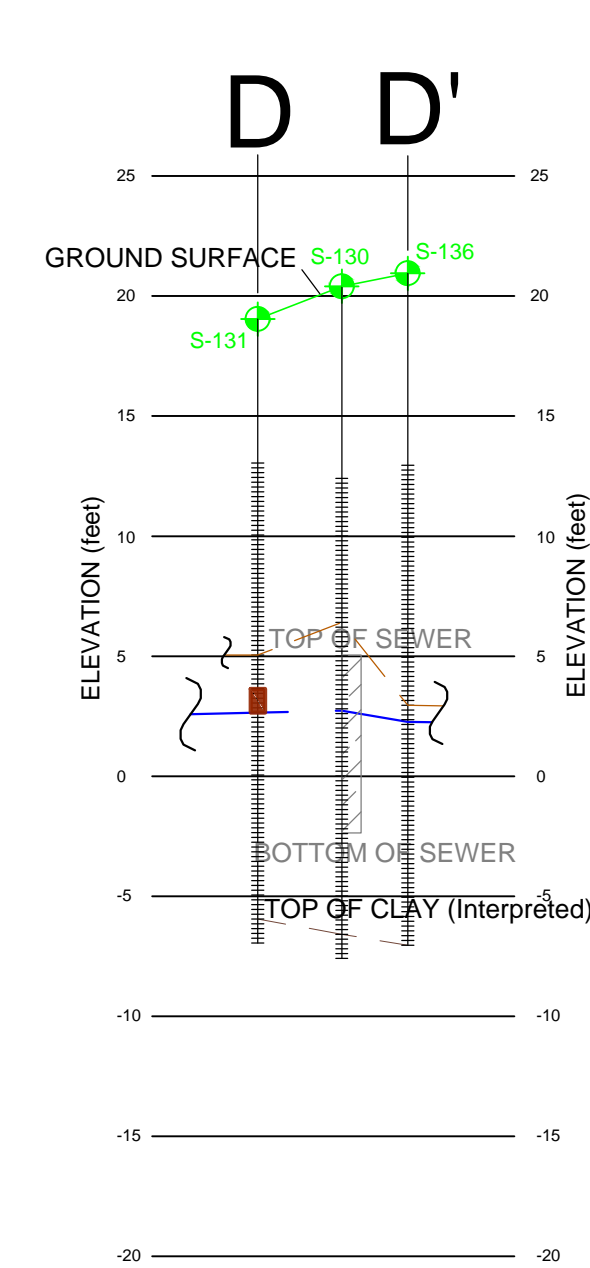
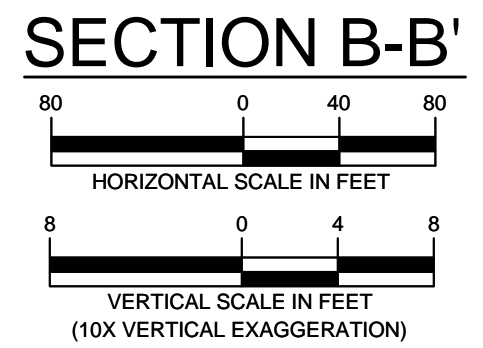
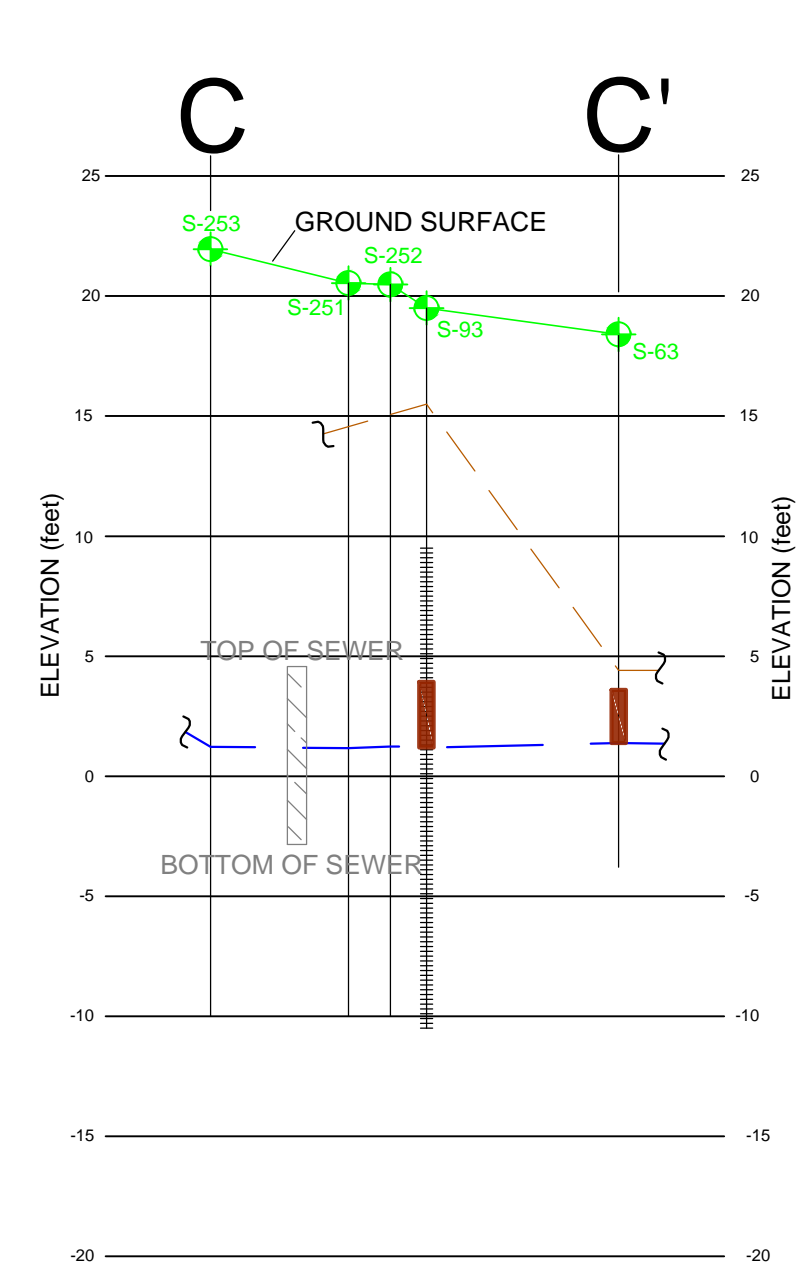
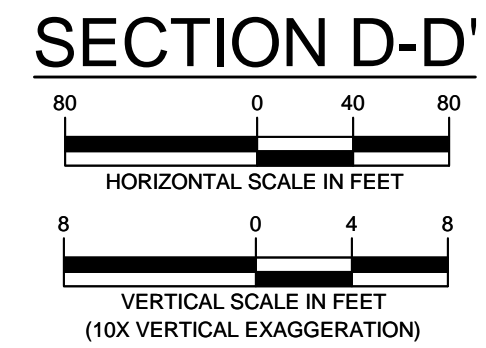
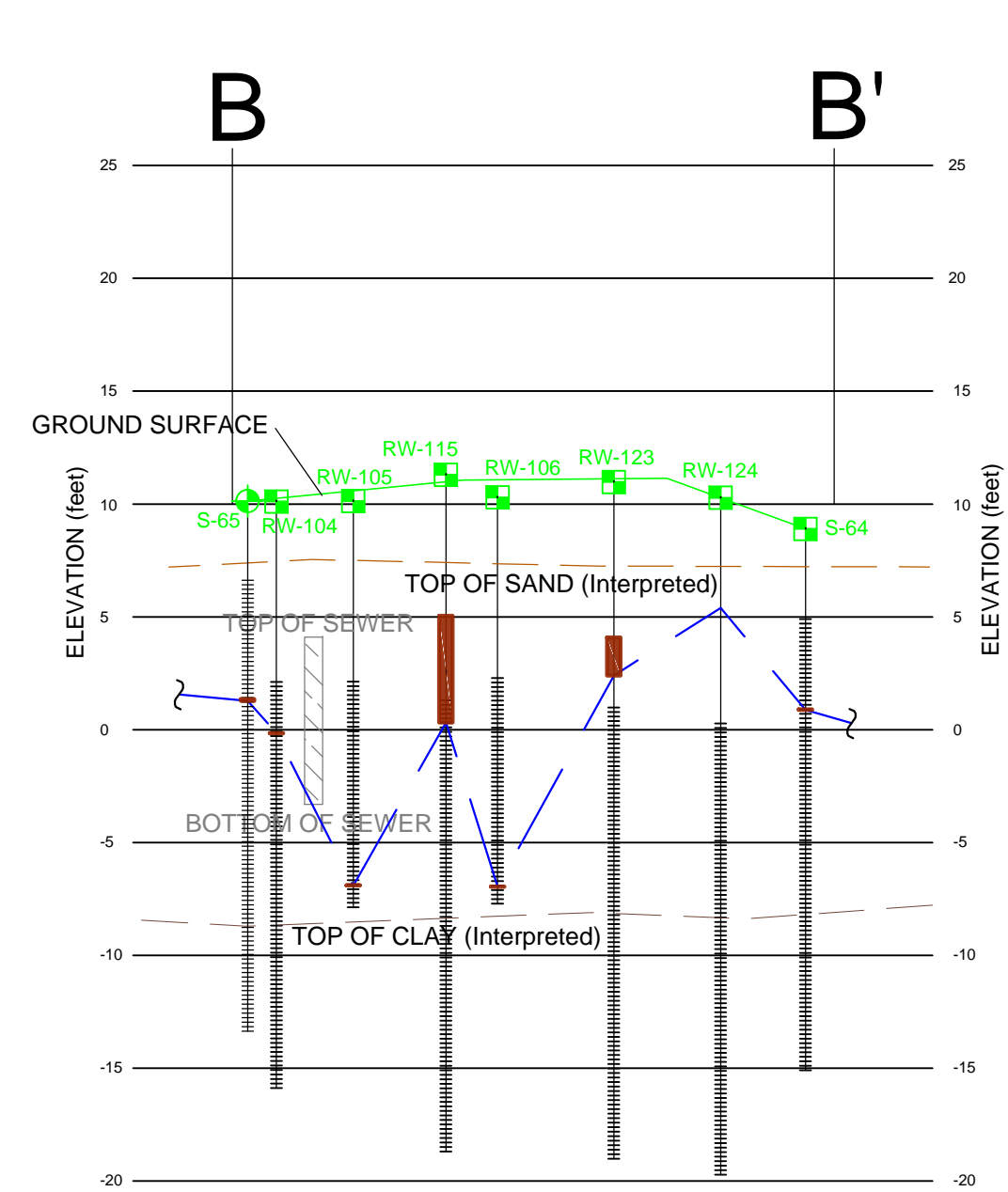
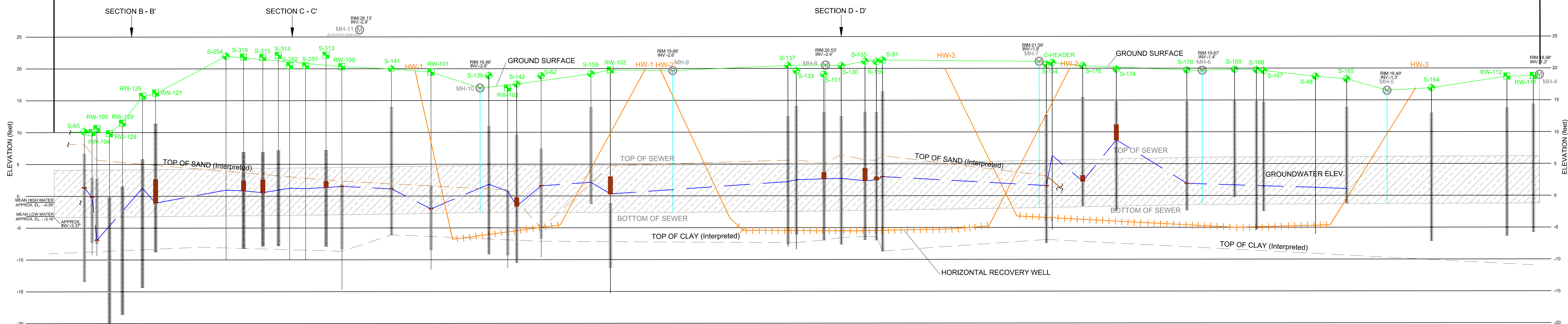
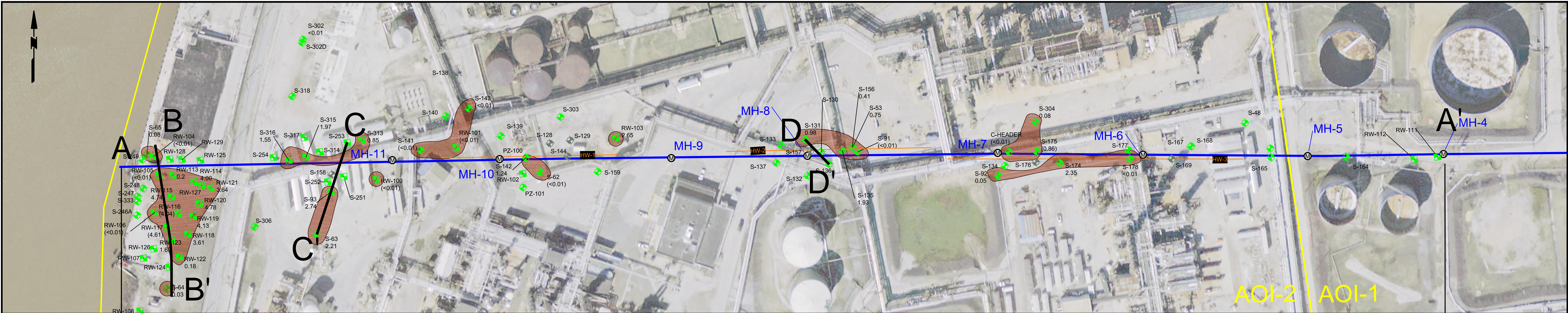
Figure 3: AOI 1 & AOI 2  
Pollock Street Sewer Observations  
May/June 2012  
Sunoco Philadelphia Refinery  
Philadelphia, Pennsylvania



0 120 240 Feet

SCALE: 1" = 120'  
DATE: May 17, 2012  
DWN BY: MM  
CKD BY: DW  
JOB#: 2074801





- LEGEND:**
- MONITORING WELLS
  - RECOVERY WELL
  - MONITORING WELLS NOT USED IN CROSS SECTION
  - SEWER MANHOLE
  - TOP OF CLAY (Interpreted)
  - TOP OF SAND (Interpreted)
  - GROUND SURFACE (Estimated)
  - WELL SCREEN INTERVAL
  - MEASURED LNAPL (JANUARY 2012)
  - CORRECTED GROUNDWATER ELEVATION JANUARY 2012
  - POLLOCK STREET SEWER
  - APPRENT LNAPL THICKNESS (JANUARY 2012)

- NOTES:**
1. ORIGINAL FIGURE "POLLOCK STREET SEWER SECTION. MAP WITH LIQUID LEVELS" OCTOBER 4, 2005, PROVIDED BY AQUATERRA TECHNOLOGIES, INC.
  2. ELEVATION DATA OBTAINED FROM MAY 2009 AND APRIL 2012 WELL SURVEYS. ELEVATIONS REFERENCED TO NAVD 88 DATUM.
  3. MEAN HIGH WATER AND MEAN LOW WATER ELEVATIONS OBTAINED FROM PLAN ENTITLED "SHEET PILING PLAN - TOP OF SEWER" BY JAMES T. SMITH ENGINEERING COMPANY.
  4. GROUNDWATER LNAPL DATA COLLECTED IN JANUARY 2012.

	<b>SUNOCO</b> PHILADELPHIA REFINERY	<b>AOI-1 &amp; AOI-2</b> January 2012 Pollock Street Sewer Cross Section Plan	Project No. <b>002574601</b>	Figure No.
			Date <b>7/13/09</b>	<b>4</b>
			Scale <b>AS SHOWN</b>	
			Drn. By <b>JWY</b>	
PHILADELPHIA COUNTY PENNSYLVANIA		Last Revised <b>5/11/12</b>		

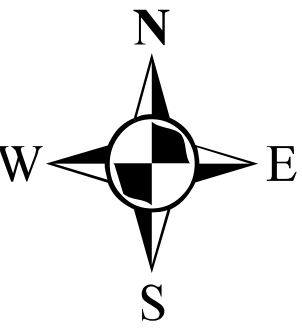












### Legend

- Shallow Monitoring Well
- Intermediate Monitoring Well
- Deep Monitoring Well
- Shallow/Intermediate Monitoring Well
- Damaged/Destroyed/Unable to Locate
- Shallow Recovery Well
- Shallow/Intermediate Recovery Well
- Intermediate Recovery Well
- Piezometer
- Staff Gauge Location
- Monitoring Well Location
- Outfall
- Sump
- APL 4
- FOM/Barge
- Pollock Street Sewer
- Apparent LNAPL Thickness (January 2012)
- AOIs

- Sulfur (Wt.%)
- 0 - 0.1415
  - 0.1416 - 0.4240
  - 0.4241 - 0.5588
  - 0.5589 - 0.9131
  - 0.9132 - 1.4795

Notes:  
1. Bing Maps aerial imagery provided by © 2010 Microsoft Corporation and its data suppliers and obtained under the licensing agreement with ESRI.  
2. LNAPL thickness based on the January 2012 groundwater gauging event.

Figure 7 - AOI-2 Percent Sulfur Plot  
April 2012  
Sunoco Philadelphia Refinery  
Philadelphia, Pennsylvania

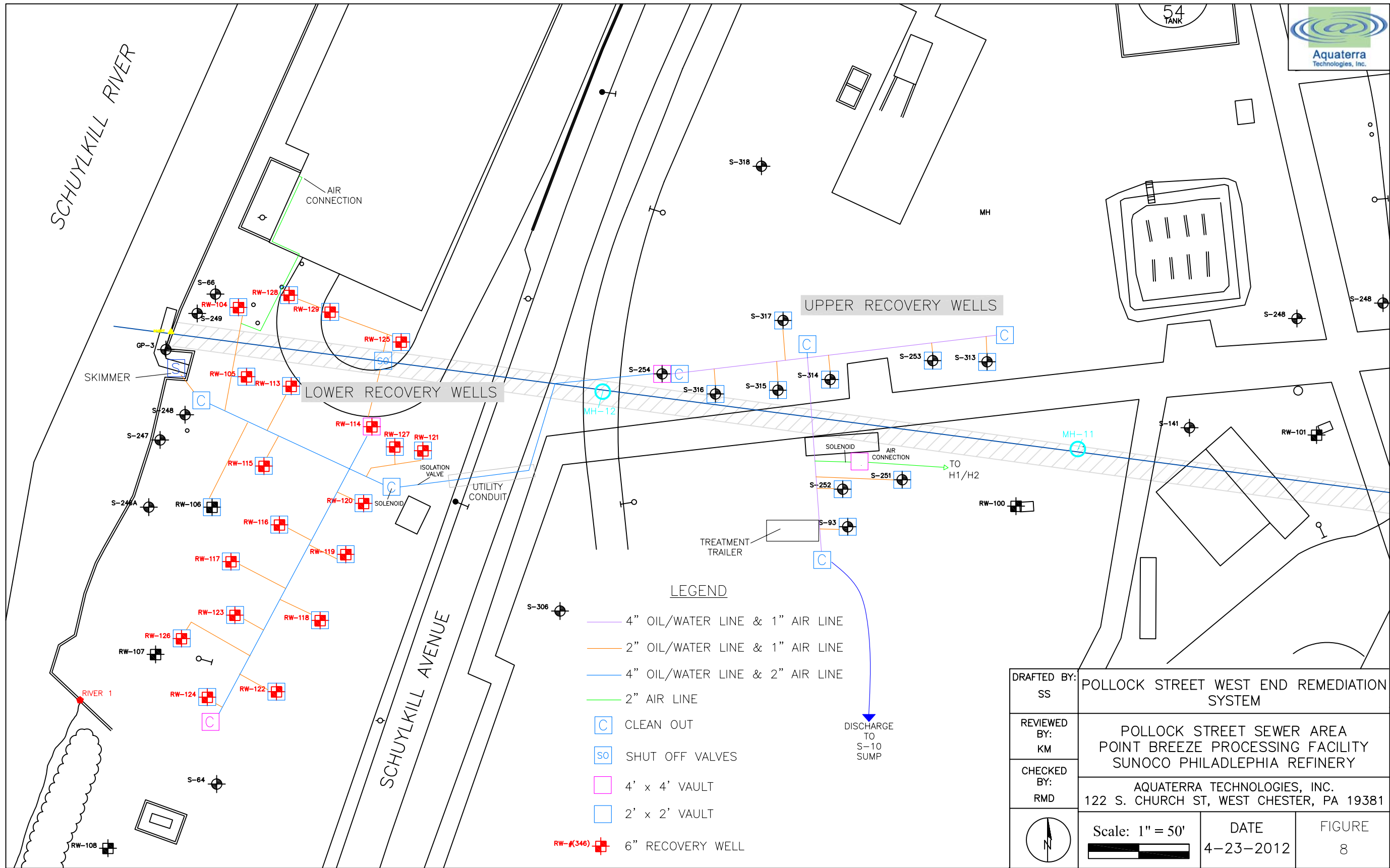


Sunoco, Inc. (R&M)  
Philadelphia Refinery  
3144 Passyunk Avenue  
Philadelphia, PA.  
19145

0 40 80 160 Feet

SCALE: 1" = 80'  
DATE: JAN 15, 2012  
DRN BY: KAH  
CDD BY: DM  
JOB#: 2571601

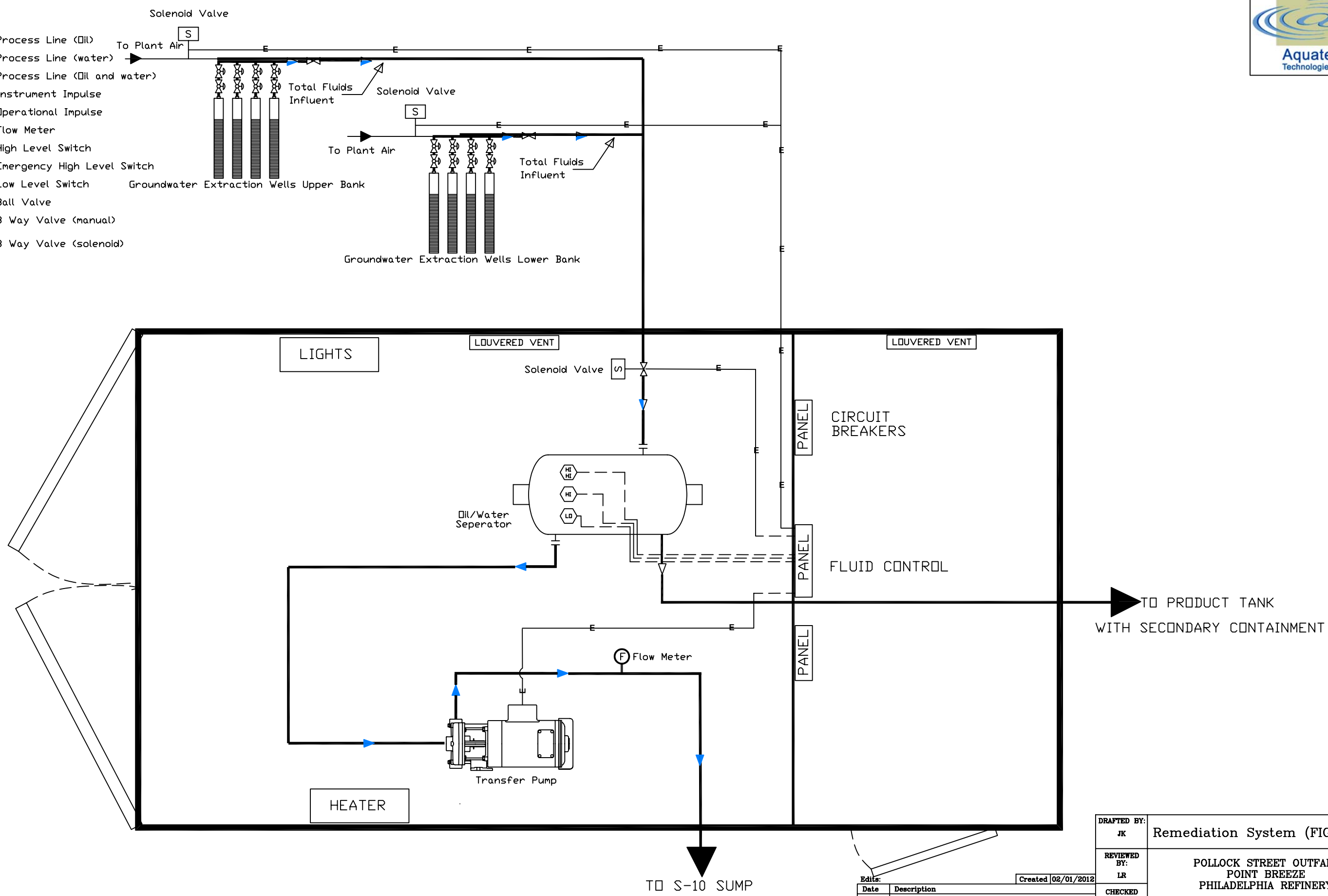




DRAFTED BY: SS	POLLOCK STREET WEST END REMEDIATION SYSTEM		
REVIEWED BY: KM	POLLOCK STREET SEWER AREA POINT BREEZE PROCESSING FACILITY SUNOCO PHILADLEPHIA REFINERY		
CHECKED BY: RMD	AQUATERRA TECHNOLOGIES, INC. 122 S. CHURCH ST, WEST CHESTER, PA 19381		
	Scale: 1" = 50'	DATE	FIGURE
		4-23-2012	8

Legend

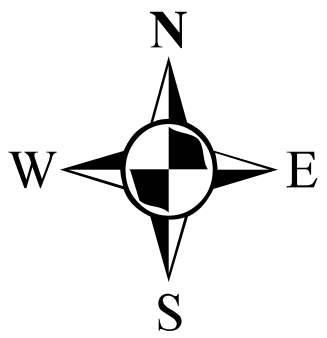
- Process Line (Oil)
- Process Line (water)
- Process Line (Oil and water)
- Instrument Impulse
- Operational Impulse
- FM
- Flow Meter
- HI
- High Level Switch
- HI
- Emergency High Level Switch
- LO
- Low Level Switch
- Ball Valve
- 3 Way Valve (manual)
- 3 Way Valve (solenoid)



DRAFTED BY:	JK	Remediation System (FIGURE 9)
REVIEWED BY:	LR	POLLOCK STREET OUTFALL POINT BREEZE PHILADELPHIA REFINERY
CHECKED BY:		AQUATERRA TECHNOLOGIES, INC. 122 S. CHURCH ST, WEST CHESTER, PA 19381

Edits:		Created 02/01/2012
Date	Description	





### Legend

- Proposed Test Pit Location
- Proposed Monitoring Well Location
- Shallow Monitoring Well
- Intermediate Monitoring Well
- Deep Monitoring Well
- Shallow/Intermediate Monitoring Well
- Damaged/Destroyed/Unable to Locate
- Shallow Recovery Well
- Shallow/Intermediate Recovery Well
- Intermediate Recovery Well
- Piezometer
- Staff Gauge Location
- Monitoring Well Location
- Invert
- Manhole
- Pollock Street Sewer
- AOIs

Notes:  
1. Bing Maps Aerial basemap is provided through Langan's Esri ArcGIS software licensing and ArcGIS online © 2010 Microsoft Corporation and its data suppliers.

Figure 10: Proposed Additional Activities  
Pollock Street Sewer  
Sunoco Philadelphia Refinery  
Philadelphia, Pennsylvania



Sunoco, Inc. (R&M)  
Philadelphia Refinery  
3144 Passyunk Avenue  
Philadelphia, PA.  
19145

0 120 240  
Feet

SCALE: 1" = 120'  
DATE: May 17, 2012  
DWN BY: MM  
CKD BY: DW  
JOB#: 2074801



# TABLES

Table 1  
Summary of Groundwater and LNAPL Elevations  
January 2012  
Pollack Street Sewer  
Sunoco Philadelphia Refinery  
Philadelphia, Pennsylvania

Monitoring Point ID	Northing	Easting	Well Type	Well Classification <sup>1</sup>	Specific Gravity (g/cc) Used for GW Correction		Depth to Product (ft btic)	Depth to GW <sup>4</sup> (ft btic)	Apparent LNAPL <sup>5</sup> Thickness (ft)	LNAPL Elevation (ft amsl)	GW Elevation (ft amsl)	Corrected GW Elevation (ft amsl)	TIC Elevation (ft amsl)	Static/ Pumping	Notes
					S.G. <sup>2</sup>	Source <sup>3</sup>									
S-117	222352.340	2685491.750	Monitoring Well	Shallow			NG	NG	NG	NG	NG	NG	18.41	Static	
S-127	222202.710	2685644.170	Monitoring Well	Shallow			NG	NG	NG	NG	NG	NG	17.1	Static	
S-162	222130.870	2685201.650	Monitoring Well	Shallow			NG	NG	NG	NG	NG	NG	18.058	Static	
S-164	222133.510	2685039.080	Monitoring Well	Shallow			NG	NG	NG	NG	NG	NG	16.696	Static	
S-208	222409.360	2685224.660	Monitoring Well	Intermediate			NG	NG	NG	NG	NG	NG	20.86	Static	
S-210	222247.030	2685875.850	Monitoring Well	Intermediate			NG	NG	NG	NG	NG	NG	23.69	Static	
S-211	221955.730	2685020.880	Monitoring Well	Intermediate			NG	NG	NG	NG	NG	NG	15.25	Static	
S-212	221992.640	2685308.790	Monitoring Well	Intermediate			NG	NG	NG	NG	NG	NG	18.37	Static	
S-213	221871.460	2685087.220	Monitoring Well	Intermediate			NG	NG	NG	NG	NG	NG	15.21	Static	
S-226	222280.360	2685805.470	Monitoring Well	Intermediate			NG	NG	NG	NG	NG	NG	22.08	Static	
S-230	222323.114	2685911.871	Monitoring Well	Intermediate			NG	NG	NG	NG	NG	NG	20.188	Static	
S-231	222219.024	2685897.343	Monitoring Well	Intermediate			NG	NG	NG	NG	NG	NG	19.939	Static	
S-232	222167.313	2685890.977	Monitoring Well	Intermediate			NG	NG	NG	NG	NG	NG	20.312	Static	
S-260	221829.636	2685845.527	Monitoring Well	Intermediate			NG	NG	NG	NG	NG	NG	21.7	Static	
S-262	222044.624	2685590.027	Monitoring Well	Intermediate			NG	NG	NG	NG	NG	NG	19.44	Static	
S-263	221828.908	2685575.879	Monitoring Well	Intermediate			NG	NG	NG	NG	NG	NG	16.78	Static	
S-269	222589.823	2685043.802	Monitoring Well	Intermediate			NG	NG	NG	NG	NG	NG	22.56	Static	
S-44	221765.331	2685821.616	Monitoring Well	Intermediate			NG	NG	NG	NG	NG	NG	23.34	Static	
S-45	221888.070	2685855.200	Monitoring Well	Intermediate			NG	NG	NG	NG	NG	NG	21.57	Static	
S-46	222077.100	2685283.210	Monitoring Well	Intermediate			NG	NG	NG	NG	NG	NG	22.56	Static	
S-46D	222025.700	2685274.000	Monitoring Well	Deep			NG	NG	NG	NG	NG	NG	15.71	Static	
S-471	222077.330	2685274.850	Monitoring Well	Intermediate			NG	NG	NG	NG	NG	NG	22.21	Static	
S-50	222241.440	2685881.340	Monitoring Well	Shallow			NG	NG	NG	NG	NG	NG	22.48	Static	
MW-28	224169.040	2685580.940	Monitoring Well	Intermediate			NG	NG	NG	NG	NG	NG	28.78	Static	
MW-29	223955.490	2685481.110	Monitoring Well	Intermediate			NG	NG	NG	NG	NG	NG	28.95	Static	
RW-110	222136.170	2685160.400	Recovery Well	Shallow			NG	NG	NG	NG	NG	NG	17.671	Static	
RW-111	222111.587	2685197.413	Recovery Well	Shallow			NG	NG	NG	NG	NG	NG	17.72	Static	
RW-112	222113.379	2685156.337	Recovery Well	Shallow			NG	NG	NG	NG	NG	NG	17.609	Static	
C-Header	222231.819	2684451.870	Monitoring Well	Shallow/Intermediate			14.31	14.31	0.00	6.30	6.30	6.30	20.61	Static	
PZ-100	222350.300	2683602.320	Temporary Piezometer	Shallow			NP	17.01	0.00	NP	1.17	1.17	18.18	Static	
PZ-101	222295.980	2683594.660	Temporary Piezometer	Shallow			NP	15.15	0.00	NP	2.02	2.02	17.17	Static	
River 1	222258.879	2682873.369	Staff Gauge	--			NA	8.05	NA	NA	NA	NA	NA	Static	Gauged @ 0900
River Gauge GP3	222425.841	2682923.822	Staff Gauge	Staff Gauge			NG	NA	NA	NA	NA	NA	9.93	Static	
RW-100	222348.922	2683341.466	Recovery Well - Active	Shallow/Intermediate			19.20	19.20	0.00	1.53	1.53	1.53	20.73	Pumping	
RW-101	222383.887	2683489.115	Recovery Well - Active	Shallow/Intermediate	0.879	S-142	21.17	21.17	0.00	-1.58	-1.58	-1.58	19.59	Pumping	
RW-102	222320.394	2683598.420	Recovery Well - Active	Shallow/Intermediate			NP	16.73	0.00	NP	1.15	1.15	17.88	Pumping	
RW-103	222358.057	2683769.861	Recovery Well - Active	Shallow/Intermediate	0.879	S-142	19.12	21.77	2.65	0.64	-2.01	0.32	19.76	Pumping	Product sampled @ 11:35
RW-104	222412.513	2682963.477	Recovery Well - Active	Shallow/Intermediate	0.9049	S-64/N-48	10.81	10.81	0.00	-0.16	-0.16	-0.16	10.65	Pumping	
RW-105	222412.513	2682963.477	Recovery Well - Active	Shallow/Intermediate	0.9049	S-64/N-48	17.56	17.56	0.00	-6.91	-6.91	-6.91	10.65	Pumping	
RW-106	222348.393	2682946.513	Recovery Well - Active	Shallow/Intermediate	0.9049	S-64/N-48	18.02	18.02	0.00	-6.96	-6.96	-6.96	11.06	Pumping	
RW-107	222276.022	2682918.762	Recovery Well - Active	Shallow/Intermediate			NP	10.08	0.00	NP	1.59	1.59	11.67	Static	
RW-108	222180.780	2682895.300	Recovery Well - Inactive	Shallow/Intermediate			NP	7.93	0.00	NP	1.97	1.97	9.9	Static	
RW-109	222084.011	2682882.538	Recovery Well - Inactive	Shallow/Intermediate			NP	7.38	0.00	NP	2.47	2.47	9.85	Static	
RW-113	222408.468	2682987.730	Recovery Well	Other	0.9049	S-64/N-48	12.05	12.25	0.20	0.48	0.28	0.46	12.53	Static	Former Temp Well D
RW-114	222391.723	2683023.069	Recovery Well	Other	0.9049	S-64/N-48	12.92	17.55	4.63	0.97	-3.66	0.53	13.89	Static	Former Temp Well E
RW-115	222370.986	2682980.232	Recovery Well	Other	0.9049	S-64/N-48	11.89	16.63	4.74	0.76	-3.98	0.31	12.65	Static	Former S-345
RW-116	222339.791	2682987.419	Recovery Well	Other	0.9049	S-64/N-48	12.86	16.90	4.04	0.82	-3.22	0.44	13.68	Static	Former S-344
RW-117	222319.545	2682964.248	Recovery Well	Other	0.9049	S-64/N-48	10.31	14.92	4.61	2.51	-2.10	2.07	12.82	Static	Former S-343
RW-118	222302.400	2682998.490	Recovery Well	Other	0.9049	S-64/N-48	12.54	16.15	3.61	0.89	-2.72	0.55	13.43	Static	Former S-341
RW-119	222331.913	2683012.961	Recovery Well	Other	0.9049	S-64/N-48	13.10	17.23	4.13	1.12	-3.01	0.73	14.22	Static	Former S-340
RW-120	222352.803	2683026.859	Recovery Well	Other	0.9049	S-64/N-48	14.04	18.82	4.78	1.37	-3.41	0.92	15.41	Static	Former S-339
RW-122	222264.480	2682978.119	Recovery Well	Other	0.9049	S-64/N-48	10.79	10.97	0.18	2.19	2.01	2.17	12.98	Static	Former Temp Well A
RW-123	222296.470	2682969.174	Recovery Well	Other	0.9049	S-64/N-48	10.33	12.02	1.69	2.56	0.87	2.40	12.89	Static	Former S-342
RW-124	222249.678	2682957.885	Recovery Well	Other			NP	8.55	0.00	NP	5.40	5.40	13.95	Static	Former Temp Well B

Notes:  
1. Well type was chosen based on the formation the well screens. Wells screened within the Middle Clay or the Farrington Sand were classified as deep wells.  
Based on their total depth, wells screened above the Middle Clay are classified as either a shallow and/or intermediate well.  
2. Specific Gravity (S.G.) values were determined from LNAPL samples collected by Aquaterra/Stantec as part of CCR and/or SCR/RIIR.  
3. For wells with no direct LNAPL density measurements, the density value in the nearest well with LNAPL data was used.  
4. Depth to water and depth to LNAPL provided by Stantec. All wells gauged January 2012.  
5. NAPL sheen (product thickness <0.01 ft) present when depth to product = depth to groundwater.  
g/cc = grams per cubic centimeter  
<.01 = Sheen or film of product on groundwater.  
LNAPL = Light Non-Aqueous Phase Liquid  
ft amsl = Feet Above Mean Sea Level  
GW = Groundwater  
NA = Not Applicable  
NG = Not Gauged  
NP = No Product  
ft btic = Feet Below Top of Inner Casing

Table 1  
Summary of Groundwater and LNAPL Elevations  
January 2012  
Pollack Street Sewer  
Sunoco Philadelphia Refinery  
Philadelphia, Pennsylvania

Monitoring Point ID	Northing	Easting	Well Type	Well Classification <sup>1</sup>	Specific Gravity (g/cc) Used for GW Correction		Depth to Product (ft btic)	Depth to GW <sup>4</sup> (ft btic)	Apparent LNAPL <sup>5</sup> Thickness (ft)	LNAPL Elevation (ft amsl)	GW Elevation (ft amsl)	Corrected GW Elevation (ft amsl)	TIC Elevation (ft amsl)	Static/ Pumping	Notes
					S.G. <sup>2</sup>	Source <sup>3</sup>									
RW-125	222427.562	2683040.456	Recovery Well	Other			NP	12.89	0.00	NP	1.29	1.29	14.18	Static	Former Temp Well F
RW-126	222285.111	2682935.525	Recovery Well	Other			NP	8.65	0.00	NP	5.41	5.41	14.06	Static	Former Temp Well C
RW-127	222383.189	2683036.131	Recovery Well	Shallow			NG	NG	NG	NG	NG	NG	13.9	Static	
RW-128	222437.797	2682987.634	Recovery Well	Shallow			NG	NG	NG	NG	NG	NG	8.43	Static	
RW-129	222434.172	2683008.073	Recovery Well	Shallow			NG	NG	NG	NG	NG	NG	9.83	Static	
RW-602	223248.570	2683337.660	Recovery Well - Inactive	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	8.13	Static	
S-105	223163.980	2683300.396	Monitoring Well	Shallow			NG	NG	NG	NG	NG	NG	12.531	Static	
S-106	223225.623	2683321.415	Monitoring Well	Shallow			NG	NG	NG	NG	NG	NG	11.363	Static	
S-107	223258.144	2683338.425	Monitoring Well	Shallow			NG	NG	NG	NG	NG	NG	12.314	Static	
S-108	223294.270	2683361.620	Monitoring Well	Intermediate			NG	NG	NG	NG	NG	NG	10.721	Static	
S-110	223250.196	2683409.695	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	25.672	Static	
S-130	222280.476	2684124.413	Monitoring Well	Shallow/Intermediate			NP	19.75	0.00	NP	2.73	2.73	22.48	Static	dry
S-131	222306.767	2684099.464	Monitoring Well	Shallow/Intermediate	0.8623	S-130	15.94	16.92	0.98	2.78	1.80	2.65	18.72	Static	Product sampled @ 2:00
S-132	222242.913	2684094.998	Monitoring Well	Shallow/Intermediate			NP	18.73	0.00	NP	2.30	2.30	21.03	Static	
S-133	222302.858	2684055.920	Monitoring Well	Shallow/Intermediate			NP	19.49	0.00	NP	2.53	2.53	22.02	Static	
S-134	222208.580	2684440.917	Monitoring Well	Shallow/Intermediate			NP	20.45	0.00	NP	1.58	1.58	22.03	Static	
S-135	222277.520	2684161.447	Monitoring Well	Shallow/Intermediate	0.8623	S-130	20.45	22.38	1.93	2.63	0.70	2.36	23.08	Static	Product sampled @ 1:50
S-136	222257.296	2684134.648	Monitoring Well	Shallow/Intermediate			NP	18.33	0.00	NP	2.26	2.26	20.59	Static	
S-137	222273.202	2684043.263	Monitoring Well	Shallow/Intermediate			NP	17.82	0.00	NP	2.22	2.22	20.04	Static	
S-139	222391.788	2683570.196	Monitoring Well	Shallow/Intermediate			NP	19.96	0.00	NP	1.50	1.50	21.46	Static	
S-140	222441.116	2683479.476	Monitoring Well	Shallow/Intermediate			NP	20.68	0.00	NP	1.35	1.35	22.03	Static	
S-141	222387.422	2683426.715	Monitoring Well	Shallow/Intermediate	0.8692	S-158	20.79	20.79	0.00	1.13	1.13	1.13	21.92	Static	
S-142	222347.586	2683608.203	Monitoring Well	Shallow/Intermediate	0.879	S-142	18.81	20.05	1.24	0.86	-0.38	0.71	19.67	Static	Product sampled @ 11:25
S-143	222448.692	2683521.683	Monitoring Well	Shallow/Intermediate			21.25	21.25	0.00	1.47	1.47	1.47	22.72	Static	
S-150	223189.281	2683393.409	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	20.831	Static	
S-153	223236.568	2683288.563	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	9.813	Static	
S-154	223235.541	2683290.309	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	10.621	Static	
S-156	222280.955	2684179.485	Monitoring Well	Shallow/Intermediate	0.8623	S-130	18.26	18.67	0.41	2.55	2.14	2.49	20.81	Static	Product sampled @ 1:40
S-159	222304.318	2683729.837	Monitoring Well	Shallow/Intermediate			NP	16.73	0.00	NP	2.14	2.14	18.87	Static	
S-165	222154.023	2684907.277	Monitoring Well	Shallow/Intermediate			NP	16.70	0.00	NP	1.41	1.41	18.11	Static	
S-166	222169.749	2684909.112	Monitoring Well	Shallow/Intermediate			NP	16.60	0.00	NP	1.63	1.63	18.23	Static	
S-167	222193.782	2684770.687	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	19.41	Static	well lost
S-174	222200.315	2684537.779	Monitoring Well	Shallow/Intermediate	0.8623	S-130	10.65	13.00	2.35	9.07	6.72	8.75	19.72	Static	Product sampled @ 2:30
S-175	222225.601	2684499.744	Monitoring Well	Shallow/Intermediate	0.8623	S-130	17.67	18.53	0.86	2.37	1.51	2.25	20.04	Static	Product sampled @ 2:40
S-177	222203.514	2684661.306	Monitoring Well	Shallow/Intermediate			NP	17.98	0.00	NP	1.58	1.58	19.56	Static	
S-178	222187.956	2684660.879	Monitoring Well	Shallow/Intermediate	0.8623	S-130	17.64	17.64	0.00	1.90	1.90	1.90	19.54	Static	
S-246A	222348.398	2682915.427	Monitoring Well	Shallow/Intermediate			NP	11.55	0.00	NP	0.21	0.21	11.76	Static	
S-247	222381.399	2682920.978	Monitoring Well	Shallow/Intermediate			NP	11.69	0.00	NP	0.40	0.40	12.09	Static	
S-248	222393.743	2682933.258	Monitoring Well	Shallow/Intermediate			NP	10.88	0.00	NP	-0.08	-0.08	10.8	Static	
S-249	222443.654	2682939.250	Monitoring Well	Shallow/Intermediate			NP	10.20	0.00	NP	2.41	2.41	12.61	Static	
S-250	222376.211	2683049.960	Monitoring Well	Shallow/Intermediate	0.8552	S-315	17.70	21.34	3.64	1.01	-2.63	0.48	18.71	Static	
S-251	222361.880	2683285.805	Monitoring Well	Shallow/Intermediate			NP	18.10	0.00	NP	1.17	1.17	19.27	Static	All 4 of these wells stick-ups have been cut down for the system upgrade. Needs to be resurvey
S-252	222357.315	2683256.882	Monitoring Well	Shallow/Intermediate			NP	18.05	0.00	NP	1.24	1.24	19.29	Static	All 4 of these wells stick-ups have been cut down for the system upgrade. Needs to be resurvey
S-253	222420.317	2683300.966	Monitoring Well	Shallow/Intermediate			NP	19.61	0.00	NP	1.22	1.22	20.83	Static	All 4 of these wells stick-ups have been cut down for the system upgrade. Needs to be resurvey
S-254	222413.854	2683167.721	Monitoring Well	Other			NP	19.92	0.00	NP	0.96	0.96	20.88	Static	All 4 of these wells stick-ups have been cut down for the system upgrade. Needs to be resurvey
S-48	222220.541	2684871.017	Monitoring Well	Shallow/Intermediate			NP	19.56	0.00	NP	1.27	1.27	20.83	Static	
S-53	222278.899	2684179.269	Monitoring Well	Shallow/Intermediate	0.8623	S-130	18.55	19.30	0.75	3.16	2.41	3.06	21.71	Static	Product sampled @ 1:30
S-54	221765.723	2684412.265	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	22.972	Static	
S-61	221700.585	2683868.702	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	18.302	Static	
S-62	222318.880	2683629.517	Monitoring Well	Intermediate			19.78	19.78	0.00	1.60	1.60	1.60	21.38	Static	
S-63	222268.556	2683223.536	Monitoring Well	Shallow/Intermediate	0.8692	S-158	19.71	21.92	2.21	1.67	-0.54	1.38	21.38	Static	Product sampled @ 10:55
S-64	222212.294	2682948.788	Monitoring Well	Shallow/Intermediate	0.9049	S-64/N-48	9.69	9.72	0.03	0.87	0.84	0.87	10.56	Static	
S-65	222451.716	2682948.180	Monitoring Well	Shallow/Intermediate	0.9049	S-64/N-48	9.33	9.41	0.08	1.29	1.21	1.28	10.62	Static	
S-70	223133.013	2683462.983	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	22.1	Static	

Notes:  
1. Well type was chosen based on the formation the well screens. Wells screened within the Middle Clay or the Farrington Sand were classified as deep wells. Based on their total depth, wells screened above the Middle Clay are classified as either a shallow and/or intermediate well.  
2. Specific Gravity (S.G.) values were determined from LNAPL samples collected by Aquaterra/Stantec as part of CCR and/or SCR/RIIR.  
3. For wells with no direct LNAPL density measurements, the density value in the nearest well with LNAPL data was used.  
4. Depth to water and depth to LNAPL provided by Stantec. All wells gauged January 2012.  
5. NAPL sheen (product thickness <0.01 ft) present when depth to product = depth to groundwater.  
g/cc = grams per cubic centimeter  
<.01 = Sheen or film of product on groundwater.  
LNAPL = Light Non-Aqueous Phase Liquid  
ft amsl = Feet Above Mean Sea Level  
GW = Groundwater  
NA = Not Applicable  
NG = Not Gauged  
NP = No Product  
ft btic = Feet Below Top of Inner Casing



Table 1  
Summary of Groundwater and LNAPL Elevations  
January 2012  
Pollack Street Sewer  
Sunoco Philadelphia Refinery  
Philadelphia, Pennsylvania

Monitoring Point ID	Northing	Easting	Well Type	Well Classification <sup>1</sup>	Specific Gravity (g/cc) Used for GW Correction		Depth to Product (ft btic)	Depth to GW <sup>4</sup> (ft btic)	Apparent LNAPL <sup>5</sup> Thickness (ft)	LNAPL Elevation (ft amsl)	GW Elevation (ft amsl)	Corrected GW Elevation (ft amsl)	TIC Elevation (ft amsl)	Static/ Pumping	Notes
					S.G. <sup>2</sup>	Source <sup>3</sup>									
S-71	223177.687	2683535.027	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	24.038	Static	
S-72	223834.943	2683824.526	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	31.057	Static	
S-72D	223838.100	2683833.766	Monitoring Well	Deep			NG	NG	NG	NG	NG	NG	34.508	Static	
S-91	222271.265	2684187.983	Monitoring Well	Intermediate	0.8623	S-130	20.13	20.13	0.00	3.00	3.00	3.00	23.13	Static	
S-92	222193.905	2684428.041	Monitoring Well	Intermediate	0.9049	S-64/N-48	11.25	11.30	0.05	8.93	8.88	8.93	20.18	Static	
S-93	222338.470	2683259.236	Monitoring Well	Intermediate	0.8692	S-158	16.70	19.44	2.74	1.55	-1.19	1.19	18.25	Static	Product sampled @ 11:05. The original stick-up has been cut down for system upgrade. Needs resurvey
SD-1	223203.927	2683363.204	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	19.112	Static	
S-292	223718.469	2683561.768	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	28.773	Static	
S-294	224162.262	2684672.756	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	34.466	Static	
S-294D	224164.508	2684682.460	Monitoring Well	Deep			NG	NG	NG	NG	NG	NG	34.679	Static	
S-295	223800.510	2684379.192	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	32.735	Static	
S-297	223495.264	2683614.221	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	30.018	Static	
S-298	223263.415	2683858.759	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	26.996	Static	
S-299	222978.196	2683545.486	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	24.003	Static	
S-300	222829.549	2684308.401	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	25.279	Static	
S-301	222550.150	2684441.814	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	23.122	Static	
S-302	222612.708	2683250.986	Monitoring Well	Intermediate			22.58	22.58	0.00	1.37	1.37	1.37	23.95	Static	
S-302D	222606.828	2683247.675	Monitoring Well	Deep			NP	23.13	0.00	NP	1.47	1.47	24.6	Static	
S-303	222409.188	2683678.208	Monitoring Well	Shallow/Intermediate			NP	21.17	0.00	NP	1.42	1.42	22.59	Static	
S-304	222276.798	2684505.689	Monitoring Well	Shallow/Intermediate	0.8623	S-130	12.70	12.78	0.08	9.48	9.40	9.47	22.18	Static	
S-305	221997.384	2684882.600	Monitoring Well	Intermediate			NP	18.35	0.00	NP	1.38	1.38	19.73	Static	
S-305D	221989.608	2684881.879	Monitoring Well	Deep			NP	19.39	0.00	NP	1.09	1.09	20.48	Static	
S-306	222297.333	2683117.453	Monitoring Well	Intermediate			NP	21.65	0.00	NP	0.82	0.82	22.47	Static	
S-307	221764.243	2683507.725	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	18.571	Static	
S-308	221383.028	2682915.492	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	28.109	Static	
S-309	221511.876	2683391.028	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	19.733	Static	
S-310	221511.275	2683799.677	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	17.396	Static	
S-311	221517.843	2684447.587	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	26.177	Static	
S-312	221608.820	2684972.955	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	17.884	Static	
S-313	222420.289	2683327.363	Monitoring Well	Shallow/Intermediate	0.8694	S-313	19.43	20.28	0.85	1.47	0.62	1.36	20.9	Static	Product sampled @ 9:50. The original stick-up has been cut down for system upgrade. Needs resurvey
S-314	222411.356	2683250.163	Monitoring Well	Shallow/Intermediate			NP	19.74	0.00	NP	0.96	0.96	20.7	Static	The original stick-up has been cut down for system upgrade. Needs resurvey
S-315	222406.181	2683224.682	Monitoring Well	Shallow/Intermediate	0.8552	S-315	19.63	21.60	1.97	0.84	-1.13	0.55	20.47	Static	Product sampled @ 10:10. The original stick-up has been cut down for system upgrade. Needs resurvey
S-316	222403.902	2683194.148	Monitoring Well	Shallow/Intermediate	0.8552	S-315	19.85	21.40	1.55	1.05	-0.50	0.83	20.9	Static	Product sampled @ 10:20. The original stick-up has been cut down for system upgrade. Needs resurvey
S-317	222440.306	2683227.244	Monitoring Well	Shallow/Intermediate			NP	19.14	0.00	NP	1.05	1.05	20.19	Static	The original stick-up has been cut down for system upgrade. Needs resurvey
S-318	222515.986	2683216.416	Monitoring Well	Shallow/Intermediate			NP	22.91	0.00	NP	0.84	0.84	23.75	Static	
S-328	222582.161	2683641.906	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	21.965	Static	
S-333	222372.334	2682919.938	Monitoring Well	Other			NP	13.51	0.00	NP	0.22	0.22	13.73	Static	

Notes:  
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3. For wells with no direct LNAPL density measurements, the density value in the nearest well with LNAPL data was used.  
4. Depth to water and depth to LNAPL provided by Stantec. All wells gauged January 2012.  
5. NAPL sheen (product thickness <0.01 ft) present when depth to product = depth to groundwater.  
g/cc = grams per cubic centimeter  
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LNAPL = Light Non-Aqueous Phase Liquid  
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Table 2  
Summary of Groundwater and LNAPL Elevations  
May 2012  
Pollack Street Sewer  
Sunoco Philadelphia Refinery  
Philadelphia, Pennsylvania

Monitoring Point ID	Northing	Easting	Well Type	Well Classification <sup>1</sup>	Specific Gravity (g/cc) Used for GW Correction		Depth to Product (ft btlc)	Depth to GW <sup>4</sup> (ft btlc)	Apparent LNAPL <sup>5</sup> Thickness (ft)	LNAPL Elevation (ft amsl)	GW Elevation (ft amsl)	Corrected GW Elevation (ft amsl)	TIC Elevation (ft amsl)	Static or Pumping	Notes
					S.G. <sup>2</sup>	Source <sup>3</sup>									
S-117	222352.340	2685491.750	Monitoring Well	Shallow			NP	17.51			0.90	0.90	18.41	Static	
S-127	222202.710	2685644.170	Monitoring Well	Shallow			NP	16.75			0.35	0.35	17.1	Static	
S-162	222130.870	2685201.650	Monitoring Well	Shallow			NP	17.43			0.63	0.63	18.058	Static	Pollock Street sewer vicinity recovery well
S-164	222133.510	2685039.080	Monitoring Well	Shallow			NP	15.90			0.80	0.80	16.696	Static	Pollock Street sewer vicinity recovery well
S-208	222409.360	2685224.660	Monitoring Well	Intermediate			NP	19.67			1.19	1.19	20.86	Static	
S-210	222247.030	2685875.850	Monitoring Well	Intermediate	0.758	S-50	24.02	24.12	0.10	-0.33	-0.43	-0.35	23.69	Static	
S-211	221955.730	2685020.880	Monitoring Well	Intermediate			NP	14.32			0.93	0.93	15.25	Static	Pollock Street sewer vicinity recovery well
S-212	221992.640	2685308.790	Monitoring Well	Intermediate			NP	17.70			0.67	0.67	18.37	Static	Pollock Street sewer vicinity recovery well
S-213	221871.460	2685087.220	Monitoring Well	Intermediate			NP	14.40			0.81	0.81	15.21	Static	Pollock Street sewer vicinity recovery well
S-226	222280.360	2685805.470	Monitoring Well	Intermediate	0.758	S-50	22.09	22.20	0.11	-0.01	-0.12	-0.04	22.08	Static	
S-230	222323.114	2685911.871	Monitoring Well	Intermediate			NP	19.98			0.21	0.21	20.188	Static	
S-231	222219.024	2685897.343	Monitoring Well	Intermediate	0.758	S-50	20.34	20.42	0.08	-0.40	-0.48	-0.42	19.939	Static	
S-232	222167.313	2685890.977	Monitoring Well	Intermediate			NP	21.01			-0.70	-0.70	20.312	Static	
S-260	221829.636	2685845.527	Monitoring Well	Intermediate			NP	23.80			-2.10	-2.10	21.7	Static	
S-262	222044.624	2685590.027	Monitoring Well	Intermediate			NP	18.70			0.74	0.74	19.44	Static	
S-263	221828.908	2685575.879	Monitoring Well	Intermediate			NP	16.45			0.33	0.33	16.78	Static	
S-269	222589.823	2685043.802	Monitoring Well	Intermediate			NP	20.60			1.96	1.96	22.56	Static	
S-44	221765.331	2685821.616	Monitoring Well	Intermediate			NP	25.84			-2.50	-2.50	23.34	Static	
S-45	221888.070	2685855.200	Monitoring Well	Intermediate			NP	22.89			-1.32	-1.32	21.57	Static	
S-46	222077.100	2685283.210	Monitoring Well	Intermediate			NP	21.77			0.79	0.79	22.56	Static	Pollock Street sewer vicinity recovery well
S-46D	222025.700	2685274.000	Monitoring Well	Deep			NP	14.86			0.85	0.85	15.71	Static	Pollock Street sewer vicinity recovery well
S-47I	222077.330	2685274.850	Monitoring Well	Intermediate			NP	21.45			0.76	0.76	22.21	Static	formerly S-47D; Pollock St sewer vicinity well
S-50	222241.440	2685881.340	Monitoring Well	Shallow			NP	22.84			-0.36	-0.36	22.48	Static	
MW-28	224169.040	2685580.940	Monitoring Well	Intermediate			NP	24.80			3.98	3.98	28.78	Static	
MW-29	223955.490	2685481.110	Monitoring Well	Intermediate	0.7945	MW-29	24.55	25.83	1.28	4.40	3.12	4.14	28.95	Static	
RW-110	222136.170	2685160.400	Recovery Well	Shallow			NP	16.98			0.69	0.69	17.671	Static	formerly S-160; Pollock St. East End
RW-111	222111.587	2685197.413	Recovery Well	Shallow			NP	17.13			0.59	0.59	17.72	Static	formerly S-172; Pollock St. East End
RW-112	222113.379	2685156.337	Recovery Well	Shallow			NP	17.00			0.61	0.61	17.609	Static	formerly S-173; Pollock St. East End
C-HEADER	222231.819	2684451.870	Monitoring Well	Shallow/Intermediate			NP	11.13			9.48	9.48	20.61	Static	
PZ-100	222350.300	2683602.320	Temporary Piezometer	Shallow			NP	18.22			-0.04	-0.04	18.18	Static	damaged; casing broken at ground surface
PZ-101	222295.980	2683594.660	Temporary Piezometer	Shallow			NP	16.88			0.29	0.29	17.17	Static	
RIVER 1	222258.879	2682873.369	Staff Gauge	--			NP	7.30			---	---	---	Static	at 4:40 pm
RW-100	222348.922	2683341.466	Recovery Well - Active	Shallow	0.879	S-142	21.65	21.89	0.24	-0.92	-1.16	-0.95	20.726	Static	
RW-101	222383.836	2683489.458	Recovery Well - Active	Shallow	0.879	S-142	22.01	24.72	2.71	-2.24	-4.95	-2.57	19.77	Pumping	
RW-102	222320.524	2683598.667	Recovery Well - Active	Shallow	0.879	S-142	17.58	19.80	2.22	-0.11	-2.33	-0.38	17.47	Pumping	
RW-103	222358.120	2683770.036	Recovery Well - Active	Shallow	0.879	S-142	21.21	21.23	0.02	-1.20	-1.22	-1.20	20.01	Pumping	
RW-104	222446.462	2682959.542	Recovery Well - Active	Shallow			NP	9.85			-0.89	-0.89	8.96	Pumping	
RW-105	222412.361	2682963.694	Recovery Well - Active	Shallow	0.949	S-64/N-48	10.27	10.28	0.01	-1.59	-1.60	-1.59	8.68	Pumping	
RW-106	222348.374	2682946.186	Recovery Well - Active	Shallow	0.949	S-64/N-48	12.76	12.77	0.01	-3.46	-3.47	-3.46	9.3	Pumping	
RW-107	222272.017	2682915.348	Recovery Well - Active	Shallow			NP	9.80			0.75	0.75	10.55	Static	
RW-108	222180.780	2682895.300	Recovery Well - Inactive	Shallow			NP	7.97			1.93	1.93	9.9	Static	
RW-109	222084.011	2682882.538	Recovery Well - Inactive	Shallow			NP	9.44			0.41	0.41	9.852	Static	
RW-113	222408.839	2682987.553	Recovery Well	Shallow			NP	13.65			-3.42	-3.42	10.23	Static	
RW-114	222391.753	2683022.894	Recovery Well	Shallow	0.949	S-64/N-48	16.55	16.57	0.02	-3.54	-3.56	-3.54	13.01	Static	
RW-115	222371.149	2682980.135	Recovery Well	Shallow	0.949	S-64/N-48	13.62	13.62	<0.01	-3.42	-3.42	-3.42	10.2	Static	
RW-116	222340.325	2682987.254	Recovery Well	Shallow	0.949	S-64/N-48	14.23	14.25	0.02	-3.42	-3.44	-3.42	10.81	Static	
RW-117	222319.910	2682964.149	Recovery Well	Shallow			NP	13.12			-3.34	-3.34	9.78	Static	
RW-118	222302.273	2682998.926	Recovery Well	Shallow			NP	15.25			-3.43	-3.43	11.82	Static	
RW-119	222332.003	2683012.657	Recovery Well	Shallow			NP	16.23			-3.38	-3.38	12.85	Static	
RW-120	222352.858	2683026.776	Recovery Well	Shallow	0.8692	S-158	16.81	18.02	1.21	-3.23	-4.44	-3.39	13.58	Static	
RW-121	222376.239	2683050.397	Recovery Well	Shallow/Intermediate	0.8692	S-158	NP	18.59			-3.29	-3.29	15.3	Static	
RW-122	222264.771	2682978.087	Recovery Well	Shallow			NP	13.60			-3.36	-3.36	10.24	Static	
RW-123	222296.448	2682969.047	Recovery Well	Shallow			NP	12.99			-3.02	-3.02	9.97	Static	
RW-124	222249.641	2682957.982	Recovery Well	Shallow	0.949	S-64/N-48	12.09	12.80	0.71	-2.93	-3.64	-2.97	9.16	Static	
RW-125	222428.048	2683040.046	Recovery Well	Shallow	0.949	S-64/N-48	14.81	14.83	0.02	-0.54	-0.56	-0.54	14.27	Static	
RW-126	222285.475	2682935.601	Recovery Well	Shallow	0.949	S-64/N-48	10.81	10.83	0.02	-1.58	-1.60	-1.58	9.23	Static	
RW-127	222383.189	2683036.131	Recovery Well	Shallow			NP	17.19			-3.29	-3.29	13.9	Static	

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3. For wells with no direct LNAPL density measurements, the density value in the nearest well with LNAPL data was used.  
4. Depth to water and depth to LNAPL provided by Stantec. All wells gauged May 2012.  
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Table 2  
Summary of Groundwater and LNAPL Elevations  
May 2012  
Pollack Street Sewer  
Sunoco Philadelphia Refinery  
Philadelphia, Pennsylvania

Monitoring Point ID	Northing	Easting	Well Type	Well Classification <sup>1</sup>	Specific Gravity (g/cc) Used for GW Correction		Depth to Product (ft btic)	Depth to GW <sup>4</sup> (ft btic)	Apparent LNAPL <sup>5</sup> Thickness (ft)	LNAPL Elevation (ft amsl)	GW Elevation (ft amsl)	Corrected GW Elevation (ft amsl)	TIC Elevation (ft amsl)	Static or Pumping	Notes
					S.G. <sup>2</sup>	Source <sup>3</sup>									
RW-128	222437.797	2682987.634	Recovery Well	Shallow			NP	9.39			-0.96	-0.96	8.43	Static	
RW-129	222434.172	2683008.073	Recovery Well	Shallow	0.949	S-64/N-48	10.43	10.44	0.01	-0.60	-0.61	-0.60	9.83	Static	
RW-602	223248.570	2683337.660	Recovery Well - Inactive	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	8.13	Static	
S-105	223163.980	2683300.396	Monitoring Well	Shallow			NG	NG	NG	NG	NG	NG	12.531	Static	
S-106	223225.623	2683321.415	Monitoring Well	Shallow			NG	NG	NG	NG	NG	NG	11.363	Static	
S-107	223258.144	2683338.425	Monitoring Well	Shallow			NG	NG	NG	NG	NG	NG	12.314	Static	
S-108	223294.270	2683361.620	Monitoring Well	Intermediate			NG	NG	NG	NG	NG	NG	10.721	Static	
S-110	223250.196	2683409.695	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	25.672	Static	
S-130	222280.476	2684124.413	Monitoring Well	Shallow/Intermediate			NP	19.74			2.74	2.74	22.48	Static	
S-131	222307.096	2684099.695	Monitoring Well	Shallow	0.8623	S-130	16.55	17.89	1.34	2.21	0.87	2.03	18.76	Static	
S-132	222242.913	2684094.998	Monitoring Well	Shallow/Intermediate			NP	9.00			12.03	12.03	21.029	Static	obstruction (vac out fitting) wedged in well
S-133	222302.858	2684055.920	Monitoring Well	Shallow/Intermediate			NP	20.03			1.99	1.99	22.024	Static	
S-134	222208.580	2684440.917	Monitoring Well	Shallow/Intermediate			NP	20.36			1.67	1.67	22.033	Static	
S-135	222277.622	2684161.965	Monitoring Well	Shallow	0.8623	S-130	21.79	22.78	0.99	1.40	0.41	1.26	23.19	Static	
S-136	222257.296	2684134.648	Monitoring Well	Shallow/Intermediate			NP	19.49			1.10	1.10	20.594	Static	
S-137	222273.202	2684043.263	Monitoring Well	Shallow/Intermediate			NP	18.56			1.48	1.48	20.044	Static	
S-139	222391.788	2683570.196	Monitoring Well	Shallow/Intermediate			NP	21.21			0.25	0.25	21.462	Static	
S-140	222441.116	2683479.476	Monitoring Well	Shallow/Intermediate			NP	21.75			0.28	0.28	22.032	Static	
S-141	222387.422	2683426.715	Monitoring Well	Shallow/Intermediate	0.8692	S-158	22.04	22.05	0.01	-0.12	-0.13	-0.12	21.923	Static	
S-142	222347.941	2683609.121	Monitoring Well	Shallow	0.879	S-142	20.09	20.23	0.14	-0.25	-0.39	-0.27	19.84	Static	
S-143	222448.692	2683521.683	Monitoring Well	Shallow/Intermediate			NP	21.97			0.75	0.75	22.719	Static	
S-150	223189.281	2683393.409	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	20.831	Static	
S-153	223236.568	2683288.563	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	9.813	Static	
S-154	223235.541	2683290.309	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	10.621	Static	
S-156	222281.293	2684179.799	Monitoring Well	Shallow	0.8623	S-130	19.05	19.26	0.21	1.79	1.58	1.76	20.84	Static	
S-159	222304.318	2683729.837	Monitoring Well	Shallow/Intermediate	0.879	S-142	17.70	17.71	0.01	1.17	1.16	1.17	18.867	Static	
S-165	222154.023	2684907.277	Monitoring Well	Shallow/Intermediate			NP	16.91			1.20	1.20	18.105	Static	
S-166	222169.749	2684909.112	Monitoring Well	Shallow/Intermediate			NP	16.39			1.84	1.84	18.229	Static	
S-167	222193.782	2684770.687	Monitoring Well	Shallow/Intermediate			NG	NG	NG		NG	NG	19.41	Static	unable to locate well
S-174	222200.505	2684537.925	Monitoring Well	Shallow	0.8623	S-130	10.06	10.10	0.04	9.56	9.52	9.55	19.62	Static	
S-175	222225.601	2684499.744	Monitoring Well	Shallow	0.8623	S-130	18.02	18.41	0.39	2.02	1.63	1.96	20.036	Static	
S-177	222203.514	2684661.306	Monitoring Well	Shallow/Intermediate			NP	18.07			1.49	1.49	19.555	Static	
S-178	222187.956	2684660.879	Monitoring Well	Shallow/Intermediate			NP	17.61			1.93	1.93	19.536	Static	
S-246A	222348.398	2682915.427	Monitoring Well	Shallow/Intermediate			NP	10.07			1.69	1.69	11.764	Static	
S-247	222381.399	2682920.978	Monitoring Well	Shallow/Intermediate			NP	10.64			1.45	1.45	12.094	Static	
S-248	222393.743	2682933.258	Monitoring Well	Shallow/Intermediate			NP	9.35			1.45	1.45	10.799	Static	
S-249	222443.654	2682939.250	Monitoring Well	Shallow/Intermediate			NP	10.54			2.07	2.07	12.613	Static	
S-250	222376.211	2683049.960	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	18.71	Static	
S-251	222361.746	2683286.034	Recovery Well	Shallow/Intermediate			NP	20.70			-1.43	-1.43	19.27	Static	
S-252	222357.389	2683256.711	Recovery Well	Shallow/Intermediate			NP	21.04			-1.75	-1.75	19.29	Static	
S-253	222420.278	2683301.006	Recovery Well	Shallow/Intermediate	0.8692	S-158	20.60	20.61	0.01	0.23	0.22	0.23	20.83	Static	
S-254	222413.634	2683168.068	Recovery Well	Other			NP	20.88			0.00	0.00	20.88	Static	
S-301	222550.546	2684441.696	Monitoring Well	Shallow/Intermediate			NP	20.11			2.98	2.98	23.09	Static	
S-302	222612.708	2683250.986	Monitoring Well	Intermediate	0.8692	S-158	23.25	23.30	0.05	0.70	0.65	0.70	23.953	Static	
S-302D	222606.828	2683247.675	Monitoring Well	Deep			NP	24.56			0.04	0.04	24.602	Static	
S-303	222409.188	2683678.208	Monitoring Well	Shallow/Intermediate			NP	22.11			0.48	0.48	22.587	Static	
S-304	222276.798	2684505.689	Monitoring Well	Shallow/Intermediate	0.8623	S-130	13.04	13.10	0.06	9.14	9.08	9.13	22.183	Static	
S-305	221997.384	2684882.600	Monitoring Well	Intermediate			NP	18.68			1.05	1.05	19.728	Static	
S-305D	221989.608	2684881.879	Monitoring Well	Deep			NP	20.17			0.31	0.31	20.475	Static	
S-306	222297.333	2683117.453	Monitoring Well	Intermediate			NP	25.26			-2.79	-2.79	22.466	Static	
S-313	222420.484	2683327.237	Recovery Well - Active	Shallow			NP	20.67			0.23	0.23	20.9	Static	
S-314	222411.244	2683250.321	Recovery Well	Shallow			NP	20.77			-0.07	-0.07	20.7	Static	
S-315	222405.894	2683224.603	Recovery Well - Active	Shallow	0.8552	S-315	21.03	22.26	1.23	-0.56	-1.79	-0.74	20.47	Static	
S-316	222403.913	2683194.137	Recovery Well - Active	Shallow			NP	20.82			0.08	0.08	20.9	Static	
S-317	222440.309	2683227.236	Recovery Well	Shallow			NP	20.12			0.07	0.07	20.19	Static	
S-318	222515.986	2683216.416	Monitoring Well	Shallow/Intermediate	0.8552	S-315	23.70	23.72	0.02	0.05	0.03	0.05	23.754	Static	
S-328	222582.161	2683641.906	Monitoring Well	Shallow/Intermediate	0.8552	S-315	20.80	20.87	0.07	1.17	1.10	1.15	21.965	Static	
S-333	222372.334	2682919.938	Monitoring Well	Shallow/Intermediate			NP	12.16			1.57	1.57	13.73	Static	
S-48	222220.541	2684871.017	Monitoring Well	Shallow/Intermediate	0.8623	S-130	19.86	19.86	<0.01		0.97	0.97	20.829	Static	

Notes:  
1. Well type was chosen based on the formation the well screens. Wells screened within the Middle Clay or the Farrington Sand were classified as deep wells.  
Based on their total depth, wells screened above the Middle Clay are classified as either a shallow and/or intermediate well.  
2. Specific Gravity (S.G.) values were determined from LNAPL samples collected by Aquaterra/Stantec as part of CCR and/or SCR/RIR.  
3. For wells with no direct LNAPL density measurements, the density value in the nearest well with LNAPL data was used.  
4. Depth to water and depth to LNAPL provided by Stantec. All wells gauged May 2012.  
5. NAPL sheen (product thickness <0.01 ft) present when depth to product = depth to groundwater.  
g/cc = grams per cubic centimeter  
<.01 = Sheen or film of product on groundwater.  
LNAPL = Light Non-Aqueous Phase Liquid  
ft amsl = Feet Above Mean Sea Level  
GW = Groundwater  
NA = Not Applicable  
NG = Not Gauged  
NP = No Product  
ft btic = Feet Below Top of Inner Casing

Table 2  
Summary of Groundwater and LNAPL Elevations  
May 2012  
Pollack Street Sewer  
Sunoco Philadelphia Refinery  
Philadelphia, Pennsylvania

Monitoring Point ID	Northing	Easting	Well Type	Well Classification <sup>1</sup>	Specific Gravity (g/cc) Used for GW Correction		Depth to Product (ft btic)	Depth to GW <sup>4</sup> (ft btic)	Apparent LNAPL <sup>5</sup> Thickness (ft)	LNAPL Elevation (ft amsl)	GW Elevation (ft amsl)	Corrected GW Elevation (ft amsl)	TIC Elevation (ft amsl)	Static or Pumping	Notes
					S.G. <sup>2</sup>	Source <sup>3</sup>									
S-53	222278.925	2684179.402	Monitoring Well	Shallow	0.8623	S-130	19.39	19.59	0.20	2.29	2.09	2.26	21.68	Static	
S-54	221765.723	2684412.265	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	22.972	Static	
S-61	221700.585	2683868.702	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	18.302	Static	
S-62	222318.880	2683629.517	Monitoring Well	Intermediate	0.879	S-142	21.15	21.16	0.01	0.23	0.22	0.23	21.377	Static	
S-63	222268.512	2683223.195	Monitoring Well	Shallow	0.8692	S-158	22.90	24.91	2.01	-1.63	-3.64	-1.89	21.27	Static	
S-64	222212.294	2682948.788	Monitoring Well	Shallow/Intermediate	0.949	S-64/N-48	11.28	11.49	0.21	-0.72	-0.93	-0.73	10.558	Static	
S-65	222451.716	2682948.180	Monitoring Well	Shallow/Intermediate	0.949	S-64/N-48	9.51	9.52	0.01	1.11	1.10	1.11	10.618	Static	
S-70	223133.013	2683462.983	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	22.1	Static	
S-71	223177.687	2683535.027	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	24.038	Static	
S-72	223834.943	2683824.526	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	31.057	Static	
S-72D	223838.100	2683833.766	Monitoring Well	Deep			NG	NG	NG	NG	NG	NG	34.508	Static	
S-91	222271.265	2684187.983	Monitoring Well	Intermediate			20.91	20.92	0.01	2.22	2.21	2.22	23.133	Static	
S-92	222194.103	2684428.327	Monitoring Well	Intermediate	0.8623	S-130	13.04	13.05	0.01	7.03	7.02	7.03	20.07	Static	
S-93	222338.436	2683259.117	Recovery Well - Active	Intermediate	0.8692	S-158	19.81	20.22	0.41	-1.56	-1.97	-1.61	18.25	Static	
SD-1	223203.927	2683363.204	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	19.112	Static	
S-292	223718.469	2683561.768	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	28.773	Static	
S-294	224162.262	2684672.756	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	34.466	Static	
S-294D	224164.508	2684682.460	Monitoring Well	Deep			NG	NG	NG	NG	NG	NG	34.679	Static	
S-295	223800.510	2684379.192	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	32.735	Static	
S-297	223495.264	2683614.221	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	30.018	Static	
S-298	223263.415	2683858.759	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	26.996	Static	
S-299	222978.196	2683545.486	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	24.003	Static	
S-300	222829.549	2684308.401	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	25.279	Static	
S-171	222152.980	2685042.040	Monitoring Well	Shallow			NG	NG	NG	NG	NG	NG	17.17	Static	Not Gauged
S-128	222366.540	2683653.780	Monitoring Well	Shallow			NG	NG	NG	NG	NG	NG	20.72	Static	Destroyed
S-129	222366.110	2683689.830	Monitoring Well	Shallow			NG	NG	NG	NG	NG	NG	21.03	Static	Destroyed
S-144	222338.230	2683681.590	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	21.71	Static	unable to locate well
S-157	222285.030	2684106.770	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	19.94	Static	Destroyed
S-158	222368.900	2683265.500	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	-	Static	unable to locate well
S-168	222194.560	2684770.850	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	19.62	Static	unable to locate well
S-169	222177.510	2684733.850	Monitoring Well	Shallow/Intermediate			NG	NG	NG	NG	NG	NG	19.29	Static	Destroyed

Notes:

1. Well type was chosen based on the formation the well screens. Wells screened within the Middle Clay or the Farrington Sand were classified as deep wells. Based on their total depth, wells screened above the Middle Clay are classified as either a shallow and/or intermediate well.

2. Specific Gravity (S.G.) values were determined from LNAPL samples collected by Aquaterra/Stantec as part of CCR and/or SCR/RIR.

3. For wells with no direct LNAPL density measurements, the density value in the nearest well with LNAPL data was used.

4. Depth to water and depth to LNAPL provided by Stantec. All wells gauged May 2012.

5. NAPL sheen (product thickness <0.01 ft) present when depth to product = depth to groundwater.

g/cc = grams per cubic centimeter

<.01 = Sheen or film of product on groundwater.

LNAPL = Light Non-Aqueous Phase Liquid

ft amsl = Feet Above Mean Sea Level

GW = Groundwater

NA = Not Applicable

NG = Not Gauged

NP = No Product

ft btic = Feet Below Top of Inner Casing

**Table 3**  
**Sulfur Analysis Results**  
**Pollack Street Sewer**  
**Sunoco Philadelphia Refinery**  
**Philadelphia, Pennsylvania**

SAMPLE ID	SAMPLE TYPE	TIMESTAMP	Sample Point Description	Location	SULFUR (WT.%)	API GRAVITY (DEG API)	BROMINE NUMBER
203808087	PBXXXX UNDEFINED PRODUCT PB	10/27/2011 9:29	POLLOCK STREET OUTFALL	Outfall			
203808088	PBXXXX UNDEFINED PRODUCT PB	10/27/2011 9:30	POLLOCK STREET OUTFALL	Outfall			
203833989	PBXXXX UNDEFINED PRODUCT PB	12/20/2011 10:58	S-250	On Short Pier by Outfall			
203833991	PBXXXX UNDEFINED PRODUCT PB	12/20/2011 11:01	S-13 Sump	North of Barrel WH			
203833992	PBXXXX UNDEFINED PRODUCT PB	12/20/2011 11:02	S-12 Sump	South of Barrel WH	0.0418	38	
203834641	PBXXXX UNDEFINED PRODUCT PB	12/21/2011 16:16	New Well E	Closest to outfall	0.3428	31.7	32.3
203834642	PBXXXX UNDEFINED PRODUCT PB	12/21/2011 16:18	S-250	On Short Pier by Outfall	0.3387	32	32.6
203834643	PBXXXX UNDEFINED PRODUCT PB	12/21/2011 16:21	S-339	On Short Pier by Outfall	0.3071	32.2	32.9
203834644	PBXXXX UNDEFINED PRODUCT PB	12/21/2011 16:23	S-340	On Short Pier by Outfall	0.2211	33.3	33.9
203834645	PBXXXX UNDEFINED PRODUCT PB	12/21/2011 16:25	S-341	On Short Pier by Outfall	0.3135	32.6	32.2
203834646	PBXXXX UNDEFINED PRODUCT PB	12/21/2011 16:28	S-342	On Short Pier by Outfall	0.4441	32.3	32.9
203834647	PBXXXX UNDEFINED PRODUCT PB	12/21/2011 16:30	S-343	On Short Pier by Outfall	0.4747	32.4	33
203834648	PBXXXX UNDEFINED PRODUCT PB	12/21/2011 16:32	S-344	On Short Pier by Outfall	0.2913	32.2	32.8
203834649	PBXXXX UNDEFINED PRODUCT PB	12/21/2011 16:34	S-345	On Short Pier by Outfall	0.3818	31.6	32.2
203840004	PBXXXX UNDEFINED PRODUCT PB	1/5/2012 9:48	S-313	Arcoss Road from Short Pier over Pollock Sewer	0.4128	31.3	
203840008	PBXXXX UNDEFINED PRODUCT PB	1/5/2012 9:48	S-315	Arcoss Road from Short Pier over Pollock Sewer	0.3670	33.6	
203840005	PBXXXX UNDEFINED PRODUCT PB	1/5/2012 9:48	S-316	Arcoss Road from Short Pier over Pollock Sewer	0.3572	33.9	
203839999	PBXXXX UNDEFINED PRODUCT PB	1/5/2012 9:48	S-63	North of 867	0.1232	33.1	
203840003	PBXXXX UNDEFINED PRODUCT PB	1/5/2012 9:48	S-93	North of 867	0.1415	33.6	
203840002	PBXXXX UNDEFINED PRODUCT PB	1/5/2012 9:48	S-142	North of 862	0.9131	27.4	
203840007	PBXXXX UNDEFINED PRODUCT PB	1/5/2012 9:48	RW103	North of 862	0.5451	30.9	
203840009	PBXXXX UNDEFINED PRODUCT PB	1/5/2012 9:48	S-131	NE of 14SB	0.4974	32.1	
203840000	PBXXXX UNDEFINED PRODUCT PB	1/5/2012 9:48	S-135	NE of 14SB	0.5588	31.7	
203840010	PBXXXX UNDEFINED PRODUCT PB	1/5/2012 9:48	S-53	NE of 14SB	0.6702	23.8	
203840011	PBXXXX UNDEFINED PRODUCT PB	1/5/2012 9:48	S-156	NE of 14SB	0.7129	27.2	
203840001	PBXXXX UNDEFINED PRODUCT PB	1/5/2012 9:48	S-175	North of 869	1.4795	20	
203840006	PBXXXX UNDEFINED PRODUCT PB	1/5/2012 9:48	S-174	North of 869	0.4240	26.4	
459286589	PBXXXX UNDEFINED PRODUCT PB	1/6/2012 0:00	S-13 SUMP	North of Barrel WH			
203840372	PBXXXX UNDEFINED PRODUCT PB	1/6/2012 8:44	POLLOCK STREET OUTFALL	Outfall			
203840373	PBXXXX UNDEFINED PRODUCT PB	1/6/2012 8:45	S-12 SUMP	South of Barrel WH			
203840374	PBXXXX UNDEFINED PRODUCT PB	1/6/2012 8:45	S-13 SUMP	North of Barrel WH			
203842479	PBXXXX UNDEFINED PRODUCT PB	1/12/2012 0:00	S-250	On Short Pier by Outfall			
203844562	PBXXXX UNDEFINED PRODUCT PB	1/18/2012 0:00	S-315	Arcoss Road from Short Pier over Pollock Sewer			
203855132	PBPSSO POLLOCK STREET SEWER OUTFALL	2/17/2012 11:58	S-315	Arcoss Road from Short Pier over Pollock Sewer	0.3416	33.7	134
203856486	PBPSSO POLLOCK STREET SEWER OUTFALL	2/21/2012 8:13	POLLOCK STREET OUTFALL	Sewer Outfall	0.1951	27.2	2.98
203856899	PBPSSO POLLOCK STREET SEWER OUTFALL	2/22/2012 10:47	POLLOCK STREET OUTFALL	Inside Skimmer	0.2574	30.2	2.85
203857190	PBPSSO POLLOCK STREET SEWER OUTFALL	2/23/2012 3:32	RW123 (was S-342)	On Short Pier by Outfall	0.4466	32	127.34
203857191	PBPSSO POLLOCK STREET SEWER OUTFALL	2/23/2012 3:33	RW118 (was S-341)	On Short Pier by Outfall	0.3344	32.3	9.16
203857192	PBPSSO POLLOCK STREET SEWER OUTFALL	2/23/2012 3:34	S-53	NE of 14SB	0.5348	27.8	39.1
203857193	PBPSSO POLLOCK STREET SEWER OUTFALL	2/23/2012 3:36	S-131	NE of 14SB	0.4792	32.2	2.86
203857194	PBPSSO POLLOCK STREET SEWER OUTFALL	2/23/2012 3:36	RW117 (was S-343)	On Short Pier by Outfall	0.4271	32	16.54
203857195	PBPSSO POLLOCK STREET SEWER OUTFALL	2/23/2012 3:37	RW122	On Short Pier by Outfall	0.4283	33.6	
203857196	PBPSSO POLLOCK STREET SEWER OUTFALL	2/23/2012 3:37	RW119 (was S-340)	On Short Pier by Outfall	0.2145	32.9	
203857197	PBPSSO POLLOCK STREET SEWER OUTFALL	2/23/2012 3:38	RW115 (was S-345)	On Short Pier by Outfall	0.3816	30.7	
203857198	PBPSSO POLLOCK STREET SEWER OUTFALL	2/23/2012 3:39	RW120	On Short Pier by Outfall	0.2512	33	
203857199	PBPSSO POLLOCK STREET SEWER OUTFALL	2/23/2012 3:39	RW106	On Short Pier by Outfall	0.3025	23.5	
203857200	PBPSSO POLLOCK STREET SEWER OUTFALL	2/23/2012 3:40	RW114	On Short Pier by Outfall	0.3173	32.3	
203857202	PBPSSO POLLOCK STREET SEWER OUTFALL	2/23/2012 4:02	RW116 (was S-344)	On Short Pier by Outfall	0.2736	32.1	

**Table 3**  
**Sulfur Analysis Results**  
**Pollack Street Sewer**  
**Sunoco Philadelphia Refinery**  
**Philadelphia, Pennsylvania**

SAMPLE ID	SAMPLE TYPE	TIMESTAMP	Sample Point Description	Location	SULFUR (WT.%)	API GRAVITY (DEG API)	BROMINE NUMBER
203857203	PBPSSO POLLOCK STREET SEWER OUTFALL	2/23/2012 4:03	S-156	NE of 14SB	0.6971	27.5	
203857204	PBPSSO POLLOCK STREET SEWER OUTFALL	2/23/2012 4:04	S-315	Arcoss Road from Short Pier over Pollock Sewer	0.3542	33.5	
203857205	PBPSSO POLLOCK STREET SEWER OUTFALL	2/23/2012 4:04	S-316	Arcoss Road from Short Pier over Pollock Sewer	0.3506	33.9	
203857206	PBPSSO POLLOCK STREET SEWER OUTFALL	2/23/2012 4:05	S-313	Arcoss Road from Short Pier over Pollock Sewer	0.4018	30.9	
203857207	PBPSSO POLLOCK STREET SEWER OUTFALL	2/23/2012 4:06	S-63	North of 867	0.1192	32.8	
203857208	PBPSSO POLLOCK STREET SEWER OUTFALL	2/23/2012 4:06	S-93	North of 867	0.1512	33.3	
203857209	PBPSSO POLLOCK STREET SEWER OUTFALL	2/23/2012 4:07	S-142	North of 862	0.8608	27.2	
203857210	PBPSSO POLLOCK STREET SEWER OUTFALL	2/23/2012 4:07	S-135	NE of 14SB	0.5352	31.8	
203857211	PBPSSO POLLOCK STREET SEWER OUTFALL	2/23/2012 4:08	S-174	North of 869	0.3851	20.6	
203857212	PBPSSO POLLOCK STREET SEWER OUTFALL	2/23/2012 4:08	S-175	North of 869	1.3776	21.9	
203858658	PBPSSO POLLOCK STREET SEWER OUTFALL	2/27/2012 11:56	POLLOCK STREET OUTFALL	Outfall	0.3229	29.7	2.01
203861865	PBPSSO POLLOCK STREET SEWER OUTFALL	3/7/2012 10:26	BARREL WAREHOUSE	BARREL WAREHOUSE	0.1789		
203861866	PBPSSO POLLOCK STREET SEWER OUTFALL	3/7/2012 10:27	OUTFALL	OUTFALL	0.2600		
203862041	PBPSSO POLLOCK STREET SEWER OUTFALL	3/7/2012 19:03	OUTFALL	OUTFALL	0.3365	29.6	2.57
203862252	PBPSSO POLLOCK STREET SEWER OUTFALL	3/8/2012 15:41	S-131	NE of 14SB	0.4729	32.1	7.25
203862253	PBPSSO POLLOCK STREET SEWER OUTFALL	3/8/2012 15:42	S-93	North of 867	0.1675	33	4.35
203862254	PBPSSO POLLOCK STREET SEWER OUTFALL	3/8/2012 15:42	S-142	North of 862	0.8719	27.3	3.05
203862255	PBPSSO POLLOCK STREET SEWER OUTFALL	3/8/2012 15:43	S-53	NE of 14SB	0.4753	27.5	4.22
203862256	PBPSSO POLLOCK STREET SEWER OUTFALL	3/8/2012 15:43	S-63	North of 867	0.1099	32.9	4.59
203862257	PBPSSO POLLOCK STREET SEWER OUTFALL	3/8/2012 15:44	RW103	North of 862	0.5321	30.6	3.29
203862258	PBPSSO POLLOCK STREET SEWER OUTFALL	3/8/2012 15:45	Combined Short Pier Recovery Wells	On Short Pier	0.33	31.5	4.52
203862259	PBPSSO POLLOCK STREET SEWER OUTFALL	3/8/2012 15:45	RW120	On Short Pier by Outfall	0.2536	32.2	4.69
203862260	PBPSSO POLLOCK STREET SEWER OUTFALL	3/8/2012 15:46	S-175	North of 869	1.4061		4.32
203862261	PBPSSO POLLOCK STREET SEWER OUTFALL	3/8/2012 15:47	S-13 SUMP	North of Barrel WH	0.0748	35.7	0.34
203862262	PBPSSO POLLOCK STREET SEWER OUTFALL	3/8/2012 15:47	S-135	NE of 14SB	0.5337	31.5	3.99
203862263	PBPSSO POLLOCK STREET SEWER OUTFALL	3/8/2012 15:48	RW119 (was S-340)	On Short Pier by Outfall	0.2282	32.7	4.35
203862264	PBPSSO POLLOCK STREET SEWER OUTFALL	3/8/2012 15:48	S-12 SUMP	South of Barrel WH	0.0169	37.4	0.19
203867229	PBPSSO POLLOCK STREET SEWER OUTFALL	3/22/2012 17:30	S-175	North of 869	1.4405	22.8	41.06
203867231	PBPSSO POLLOCK STREET SEWER OUTFALL	3/22/2012 17:31	S-315	Arcoss Road from Short Pier over Pollock Sewer	0.3513	34.1	1.57
203867232	PBPSSO POLLOCK STREET SEWER OUTFALL	3/22/2012 17:32	S-63	North of 867	0.1187	32.9	4.53
203867233	PBPSSO POLLOCK STREET SEWER OUTFALL	3/22/2012 17:33	S-142	North of 862	0.8938	27.3	5.45
203867234	PBPSSO POLLOCK STREET SEWER OUTFALL	3/22/2012 17:34	RW120	On Short Pier by Outfall	0.1803	33	4.56
203867235	PBPSSO POLLOCK STREET SEWER OUTFALL	3/22/2012 17:34	S-131	NE of 14SB	0.4842	32.1	2.39
203867236	PBPSSO POLLOCK STREET SEWER OUTFALL	3/22/2012 17:35	S-93	North of 867	0.1849	32.8	3.47
203867237	PBPSSO POLLOCK STREET SEWER OUTFALL	3/22/2012 17:36	S-135	NE of 14SB	0.5439	31.6	2.85
203867238	PBPSSO POLLOCK STREET SEWER OUTFALL	3/22/2012 17:36	RW-103	North of 862	0.5445	30.8	2.86
203867239	PBPSSO POLLOCK STREET SEWER OUTFALL	3/22/2012 17:37	BARREL WAREHOUSE PIT	BARREL WAREHOUSE	0.2744	28.6	1.37
203880150	PBPSSO POLLOCK STREET SEWER OUTFALL	4/27/2012 14:14	S-175	North of 869	1.1034	22.8	4.31
203880151	PBPSSO POLLOCK STREET SEWER OUTFALL	4/27/2012 14:15	S-135	NE of 14SB	0.5397	31.6	5.4
203880152	PBPSSO POLLOCK STREET SEWER OUTFALL	4/27/2012 14:16	S-174	North of 869	0.606		
203880153	PBPSSO POLLOCK STREET SEWER OUTFALL	4/27/2012 14:17	S-315	Arcoss Road from Short Pier over Pollock Sewer	0.3477	34.1	1.55
203880155	PBPSSO POLLOCK STREET SEWER OUTFALL	4/27/2012 14:18	S-63	North of 867	0.1201	32.6	1.31
203880156	PBPSSO POLLOCK STREET SEWER OUTFALL	4/27/2012 14:19	RW124	On Short Pier by Outfall	1.16	26.4	4.86
203880157	PBPSSO POLLOCK STREET SEWER OUTFALL	4/27/2012 14:19	S-93	North of 867	0.2136	32.4	4.68
203880158	PBPSSO POLLOCK STREET SEWER OUTFALL	4/27/2012 14:20	S-131	NE of 14SB	0.4817	32.1	1.91

Table 3  
Sulfur Analysis Results  
Pollack Street Sewer  
Sunoco Philadelphia Refinery  
Philadelphia, Pennsylvania

SAMPLE ID	SAMPLE TYPE	TIMESTAMP	Sample Point Description	Location	SULFUR (WT.%)	API GRAVITY (DEG API)	BROMINE NUMBER
203880159	PBPSSO POLLOCK STREET SEWER OUTFALL	4/27/2012 14:21	S-64	On Short Pier by Outfall	0.9674	27	4.11
203880160	PBPSSO POLLOCK STREET SEWER OUTFALL	4/27/2012 14:21	RW120	On Short Pier by Outfall	0.1422	33.5	4.26
203880161	PBPSSO POLLOCK STREET SEWER OUTFALL	4/27/2012 14:22	BARREL WAREHOUSE	BARREL WAREHOUSE	0.2966	22.2	1.93
203884048	PBPSSO POLLOCK STREET SEWER OUTFALL	5/4/2012 8:00	S-13 SUMP	North of Barrel WH	0.1888	32.8	
203884042	PBPSSO POLLOCK STREET SEWER OUTFALL	5/8/2012 9:22	S-13 SUMP	North of Barrel WH			
203884047	PBPSSO POLLOCK STREET SEWER OUTFALL	5/8/2012 9:51	S-12 SUMP	South of Barrel WH	0.0847	34.4	
203884049	PBPSSO POLLOCK STREET SEWER OUTFALL	5/8/2012 9:52	POLLOCK ST SEWER	From rope-a-dope collection pan	0.3632	27.9	
203884529	PBPSSO POLLOCK STREET SEWER OUTFALL	5/9/2012 16:14	S-13 SUMP	North of Barrel WH	0.9866	27.66	5.29

# **APPENDIX A**

## **Sewer Inspection Notes**

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**Sunoco Philadelphia Refinery  
Pollock St. Sewer  
Inspection Notes of Video Inspection  
December 2011**

Aquaterra Technologies Inc. (Aquaterra), has provided direction of the inspection and review of videotaping of the Pollock Street sewer at the Philadelphia Refinery by GE Inspection Technologies (GEIT). This project commenced on 22 November 2011 and was completed on 19 December 2011.

The inspection began at the eastern end of the sewer as it enters the refinery at the interceptor chamber, and flows downstream to the outfall at the Schuylkill River. The sewer runs in an East-West orientation through the facility. There are 12 manholes between the interceptor chamber and the outfall. Inspection segments are noted as “MH1-MH2” etc. These designations are reversed at times, which means that the inspection process began at a higher numbered manhole, and was performed in an upstream orientation.

The sewer is a 12’x 8” concrete combined storm water / wastewater sewer (CSO) with a “V” bottom . There are joints every 22’. There are also structures referred to as ‘lift holes’ within 5’ of each joint on both sides of the sewer. The sewer was constructed in the 1920s.

During the inspection and video review, notations of infiltration by water, potential oil, and mineralization are noted. The quality of the water surface within the sewer is also noted.

**INSPECTION NOTES**

**Junction Box at 26<sup>th</sup> St. to MH2**

- Water clear.
- 9’ Water infiltration South side
- 38’ joint infiltration North, roof and South side. Sewer surface water clear.
- 57’ joint infiltration North, roof and South side. Sewer surface water clear.
- 78’ MH 1
- 100’ Water infiltration North side. Water clear
- 122’ joint infiltration North, roof and South side. Sewer surface water clear.
- 148’ Water infiltration South side
- 240’ joint infiltration North and South side. Sewer surface water clear.
- 315’ joint infiltration North and South side. Sewer surface water clear.

- 336' MH 2.
- MH 2- MH3 was not found on video.

#### MH 4- MH 3

- 11' North and South side - floor to wall joint water infiltration. Sewer surface water clear.
- Note: The floor to wall infiltration continues until 220'. Heaviest at 180' on South side. Sewer surface water clear 270' MH3

#### MH 4-MH 5

- 65'-110' staining noted at floor to wall joint, both sides. Not active. Sewer surface water clear.
- 140' Lift hole North side and floor to wall joint staining. Not active. Sewer surface water clear.
- 160' Stain on South side, not active. Sewer surface water clear.
- 190'-200' South side, Roof and North side staining.
- 210' roof joint infiltration. Sewer surface water clear.
- 230' MH 5. Sewer surface water clear.

#### MH 7-MH 6

- Water is higher, still clear of oil. Flow moving upstream. Switch camera from crawler to boat.
- 2<sup>nd</sup> joint, roof active water leak
- 4<sup>th</sup> joint roof active, all water
- 6<sup>th</sup> joint roof active, all water
- 7<sup>th</sup> joint, odd circular feature noted on previous videos. Not active. Sewer surface water clear.
- 9<sup>th</sup> through 11<sup>th</sup> joint. Dry south side, mineralization on north side. Sewer surface water clear.

#### MH 8- MH 9

- Note. Video clarity poor. Sewer surface water clear throughout. Camera underwater at 144'
- MH 9 at 230'

#### MH 10-MH 9

- Note: utilizing camera boat, so no footage available. Inspection references number of joints of the sewer. Tide is slack.
- Joint 1. Heavy roof infiltration, Sewer surface water clear.
- Halfway to joint 2 heavy infiltration, floor to wall joint on North side. Sewer surface water clear.
- Joint 2. Stain on roof. Not active.
- Joint 3. Mineralization, South side. Not active.
- Joints 4 and 5 dry.
- Joint 6. Active roof seep. Sewer surface water clear.
- MH 9 Active joint at roof just past MH 9 . Sewer surface water clear.

#### MH-10-MH 11

First and second attempts. Utilizing crawler.

- Note. Oil present at slack tide.
- At MH 10. Roof stained, north side, not active.
- 5' joint, active, oil droplets noted
- 10' - 20' roof stained, North side and wall
- 60' joint, stained, not active.
- 114' roof stained not active North side.
- Crawler underwater at 144'.
- Back to Video. MH 10 to Outfall utilizing camera boat.
- Roof staining between 1<sup>st</sup> and second joint, N side. Water clear
- Joint 2. Roof infiltration active. Water clear.
- Joint 3. Mineralization at roof, inactive. North wall active. Radial crack with light inflow also noted.
- Roof to wall stains noted both sides, continuous to MH 11 appear inactive. Lift holes have mineralization, but appear inactive.
- MH 11. Joint infiltration appears clear of oil droplets.
- Note: Continue to MH 12. Notations were made during an attempt to pull the boat behind the crawler, between MH 11- MH12 on an earlier run. These were not recorded on video. However possible oil was noted at joints, 65', 95', 103' (oil droplets definitely noted here), 107', and 149'.
- MH 11 joint infiltration, appears clear.
- Joint 3. Active roof joint, sewer surface water oily.
- Joint 6. Very active infiltration north side at base below lift hole, does not appear oily.

- Joint 9. Active roof joint, questionable oil/water.
- Joint 12 Roof joint and south side, heavy inflow, possibly oil/water.

MH12- Outfall. Utilizing camera boat.

- Notes: Pipe entering MH 12, appears inactive and not oily.
- Observation during an earlier attempt noted possible oil inflow at first and second joints from outfall going towards MH 12 (upstream) on South side of sewer. These were not seen on video.
- Video inspection notes are from MH 12 to outfall.
- 1<sup>st</sup> Joint active at roof, possible oil. Sewer surface water oily.
- Continuous suspect roof-to-wall intersections throughout the run.
- Joint 2 Infiltration South side.
- Joint 3 Roof infiltration. Questionable oil/water
- Joint 4 (4 joints from outfall) heavy infiltration, with heavy oil on sewer surface water, North side.
- Joint 5 (3 joints from outfall) some infiltration, suspicious area, south side at wall/water interface. Roof water infiltration noted between joints.
- Joint 6 (2 joints from outfall) minor roof infiltration noted.
- Joint 7 (1 joint from outfall), Roof infiltration noted, questionable oil/water.

**Sunoco Philadelphia Refinery  
Pollock St. Sewer  
Inspection Notes of Video Inspection  
May/June 2012**

Inspection of Pollack Street Sewer from 29 May 2012 to 1 June 2012. Inspection services were performed by GE Inspection Technologies, with Aquaterra providing oversight of video operations. GE performed the remote visual inspection using both a Rovver® robotic crawler and a floating barge fitted with a pan-and-tilt color video camera with the ability to switch from white light to black (ultraviolet) light. Theoretically, the ultraviolet light would cause any light non-aqueous phase liquid (LNAPL) (petroleum) present to fluoresce making identification easier. However, obvious LNAPL did not fluoresce and in some locations where evident mineralization was observed there was some fluorescence. Therefore, all observations below were under white light.

Due to high water levels in the sewer between the sewer outfall and manhole #7 (MH-7), the floating barge was used for video inspection. The robotic crawler fitted with the same camera was used between MH-7 and MH-1A due to low water or absence of standing/flowing water in those areas. Utilization of the Rovver® allowed for specific distances to be recorded along the inspection path. However, distances could not be recorded when the barge was utilized. Note that some measured distances to observations recorded during the inspection when the Rovver® was used are moving up-flow in the sewer from a higher numbered manhole to a lower numbered manhole (west to east) and some observations are recorded in the down-sewer direction (east to west).

It should be noted that many joints between concrete sections within the sewer had active dripping of water from the ceiling and/or mineralization evidencing past leakage in those areas. However, these observations are not recorded below unless there was staining or evidence of leakage of liquid other than water. In addition, not all joints were evident. If no mineralization or staining was present at the joint location it may have not been visible through the camera; therefore, distances between joint observations may not be regular. A description of 'black' versus 'oily' is used for much of the staining observed due to the inability to determine through camera observation if the staining was due to biological activity or oil migration.

Distances referenced below are measured from the starting point of each run. For example, if the run is from MH-3 to MH-2 the distance referenced would be from directly below MH-3 where the Rovver® or barge was lowered into the sewer.

## **INSPECTION NOTES**

### **MH-2 to MH-1A (Junction Box at 26<sup>th</sup> St.)**

- Joint #3 at ~51' has black staining, but no active flow or obvious signs of LNAPL.
- All other joints observed were clear of staining or major leakage.
- Interceptor chamber at MH-1A was not entered into by the Rovver® due to standing water of unknown depth.

### **MH-3 to MH-2**

- Joint #1 at ~8' has little black staining at wall/ceiling intersection.
- Joint #3 at ~87' has black staining on south side of the sewer, no flow.
- Joint #4 at ~105' has black staining on south side.
- All other joints were clear of staining or major leakage.

### **MH-3 to MH-4**

- Joint #2 at ~52' has a small water leak at the wall/floor intersection on the south side.
- At ~87' there is a water leak at the wall/floor intersection on south side.
- At ~99' there are two leaks in the wall/floor intersection on the north side – both are clear.
- At ~111' there are two larger water leaks on the south side.
- Between ~197' and 203' there are a few water leaks at the floor/wall intersection on north and south sides.

### **MH-5 to MH-4**

- Between Joint #1 (~40' from manhole) and Joint #2 (at ~75'), there were a few areas where water had historically come through cracks (as evidenced by mineralization) but there was no active flow at the time.
- All other joints observed were clear of staining or major leakage.

### **MH-6 to MH-5**

- At ~13' a heavy water leak was observed from wall/floor intersection (note that a second pass of MH-6 to MH-5 was performed the day after the first pass. There was heavy rain before the first pass so a second run was performed later to see if flow had changed). The area at 13' was still leaking, but less flow observed.
- At ~33' water coming in heavily (possibly 1 gpm) from wall/floor intersection on the north side. Product globules observed coming through joint with water. (Second view of this leak appeared to be about the same flow – floating globules were observed in sewer approaching the leak).

- At ~70' (or possibly 79' depending on line slack) there is an oil leak on the north side wall/floor intersection (second pass looked about the same, some water coming in with oil this time). This leak is more of dripping/oozing oil through the wall above the floor/wall intersection.
- Joint #2 at ~89' the ceiling appears dark/stained.
- Joint #3 at ~121' the ceiling has some black staining.

#### MH-6 to MH-7

- Few feet down on south side at a lift hole there is black staining – possible past oil leak, but no active flow.
- Joint #1 at ~10' black staining at ceiling.
- Joint #2 at <50' there were black stains on the north wall.
- Joint #7 at ~180' has black staining at top and dripping appearance on north side – but not active.
- Joint #8 at ~207' has same appearance as Joint #7.

#### MH-8 to MH-7

- Joint #1 has little water dripping. There are numerous cracks one after the other a few feet apart after Joint #1 – all look OK (no water or oil leakage).
- Joints #6 through #9 all have black staining around the areas of mineralization, but no active flow.
- \* Joint #10 on the north side at joint there is obvious active flow of oil and water. Oil is pooling in sewer water. The leak is ~2'-3' above the water level in sewer (note: almost at low tide and water is near bottom of sewer). There are black areas around joint on south side, but no flow. A line was used to measure the distance from the manhole to this leak – leak is approximately 150' from MH-7 toward MH-8.
- Joint #13 – pinhole leak of water on south side.

#### MH-9 to MH-8

- Near #1 joint on north side – area of water flow.
- Joint #1 on north side looks black but no flow.
- Joint #2 possible black seepage on north side ceiling.
- North side between Joint #1&2 possible seepage.
- Just before Joint #3 on south side there is heavy water leakage.
- Joints #3 and #4 both have black staining at ceiling but only water dripping.

#### MH-9 to MH-10

- South side of sewer at the manhole (#9) there is an E-W running crack ~4' above water line at the time which has active seeping. Seep appears black with possible sheen.
- Joint #1 actively leaking water at joint from ceiling – on south wall looks like active black seep.
- ~4'-5' past Joint #1 on south side is active leak (water only?).
- Joint #2 roof at north wall has black discoloration. Possible oil seepage from joint on south wall. Oil globs are visible on water past joint #2.
- Around lifting hole on south side there is black seepage through wall.
- South side past Joint #3 near a lifting hole there is black staining with possible sheen and shimmering in light – appears to be actively seeping through wall.
- Joint #5 on north side has black seepage from top of sewer – mineralization is 'coated' with black.
- Active pinhole leak (water only) between Joints 5&6.

#### MH-10 to Sewer Outfall

- Note that joint numbers between MH-10 and MH-12 are consecutive (i.e. did not start to renumber from one MH to the next as with other observations).
- Joints between MH-10 and MH-11 had heavy mineralization showing past active leaking. No active leaking of oil at time inspection (note high water in sewer).
- At Joint #2 on the south side there was black staining just above water level (appears like top of areas leaking further up sewer where water is lower).
- MH-11 just before Joint #4. All good.
- Just past Joint #5 on north side is an active pinhole leak (water only).
- MH-12 and Joint #8 no problems. Black globs on water clearly oil. Source unknown (up-sewer).
- Joint #12 – mineralization looks black but no active flow.
- Joint #13 fairly open crack. On south side looks like oil around joint above water, but no flow apparent (possibly leaking below water level?.)



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# **APPENDIX B**

## **2010 & 2011 FOM Barge Line Pressure Test Results**

# Line Test Information Sheet

NO.		TEST DATE. <b>11-10-10</b>		JOB NO.		SHEET	
TEST PRESSURE <b>225#</b>				TITLE <b>FOM LINE (DELOACH)</b>			
TEST MEDIUM <b>NITROGEN</b>							
PNEUMATIC TEST		ENERGY LEVEL		PLT NO. <b>SUNOCO, PHILA.</b>		LOC. <b>POINT BREEZE WHARF</b>	
LINE NUMBER		FROM		TO			
<b>FOM LINE</b>		<b>DELOACH DOCK</b>		<b>SYOM (14<sup>TH</sup> &amp; M AVE.)</b>			
PRE-TEST		TESTER <i>Harry Franceschi</i>		DATE <i>11/10/10</i>			
INSPECTION COMPLETED		OWNER'S REPRESENTATIVE <i>John B. L...</i>		DATE <i>11/10/10</i>			
TEST WITNESSED		TESTER <i>Harry Franceschi</i>		DATE <i>11/10/10</i>			
		OWNER'S REPRESENTATIVE <i>John B. L...</i>		DATE <i>11/10/10</i>			
TEST ACCEPTED		BY <i>Harry Franceschi</i>		DATE <i>11/10/10</i>			
CONDITIONS OF ACCEPTANCE <b>SLOWLY PRESSURED LINE TO 225#</b> <b>RELAXED LINE FOR 30 MIN. (WALKED LINE -- NO LEAKS FOUND)</b> <b>TESTED LINE FOR 1 HR. (WALKED LINE -- NO LEAKS FOUND)</b> <b>0# PRESSURE DROP IN 1 HR.</b>							
<b>LUBED AND GREASED ALL VALVES</b>							
REMARKS <b>GOOD TEST</b>							

# Davis Calibration

## Certificate of Calibration



4461

Certificate P. 1

Company ID: 504491  
SUNOCO - PHILADELPHIA REFINERY

PO Number: .

3144 WEST PASSYUNK AVENUE  
PHILADELPHIA, PA 19145

Instrument ID: 0108/300  
Manufacturer: AMETEK  
Description: TEST GAUGE ( $\pm 0.5\%$ )

Model Number: 1981LG  
Serial Number: N/A

Accuracy:  $\pm 0.5\%$  of Span

### Certificate Information

Reason For Service: CALIBRATION  
Type of Cal: NORMAL  
As Found Condition: IN TOLERANCE  
As Left Condition: LEFT AS FOUND  
Procedure: 33K6-4-427-1

Technician: ERIC SPEARS  
Cal Date: 10Sep2010  
Cal Due Date: 10Sep2011  
Interval: 12 MONTHS  
Temperature: 19.0 C  
Humidity: 49.0 %

Remarks:

The instrument on this certification has been calibrated against standards traceable to the National Institute of Standards and Technology (NIST) or other recognized national metrology institutes, derived from ratio type measurements, or compared to nationally or internationally recognized consensus standards.

A test uncertainty ratio (T.U.R.) of 4:1 ( $K=2$ , approx. 95% Confidence Level) was maintained unless otherwise stated.

Davis Calibration Laboratory is certified to ISO 9001:2008 by Eagle Registrations (certificate # 3046). Lab operations meet the requirements of ANSI/NCSL Z540-1-1994 (R2002), ISO 10012:2003, 10CFR50 AppxB, and 10CFR21.

ISO/IEC 17025:2005 accredited calibrations are per ACLASS certificate # AC-1203 within the scope for which the lab is accredited.

When uncertainty measurements calculations have been calculated per customer request, reported condition statements do not take into account uncertainty of measurement. All results contained within this certification relate only to item(s) calibrated. Any number of factors may cause the calibration item to drift out of calibration before the instrument's calibration interval has expired.

This certificate shall not be reproduced except in full, without written consent of Davis Calibration Laboratory.

Approved By: ERIC SPEARS  
Service Representative

### Calibration Standards

NIST Traceable#	Inst. ID#	Description	Model	Cal Date	Date Exp
3483791	14-0011	TEMP/HUMIDITY RECORDER	CT485	01Sep2009	30Sep2010
143807	14-0190	REFERENCE PRESSURE MONITOR	RPM4 A3.5MP/A3	21Aug2009	30Sep2010



4401

Certificate Page 1

✓ In Tolerance ✗ Out of Tolerance

### Calibration Data

Range	Nominal	As Found	As Left	Min	Max
Pressure Calibration in PSI					
	60.0	58.8	✓	58.8	✓
	120.0	119.1	✓	119.1	✓
	180.0	179.8	✓	179.8	✓
	240.0	240.4	✓	240.4	✓
	300.0	300.7	✓	300.7	✓
				298.5	301.5

End of Datasheet

# Line Test Information Sheet

TEST NO.		TEST DATE. <b>12/07/11</b>		JOB NO.		SHEET	
TEST PRESSURE <b>225#</b>				TITLE <b>FOM LINE (DELOACH)</b>			
TEST MEDIUM <b>NITROGEN</b>							
PNEUMATIC TEST		ENERGY LEVEL <b>HYDROSTATIC TEST</b>		PLT NO. <b>SUNOCO, PHILA.</b>		LOC. <b>GIRARD POINT WHARF</b>	
LINE NUMBER		FROM		TO			
<b>FOM LINE</b>		<b>DELOACH DOCK</b>		<b>SYOM(14<sup>th</sup> &amp; M AVE.)</b>			
PRE-TEST		TESTER		DATE			
INSPECTION COMPLETED		OWNER'S REPRESENTATIVE		DATE			
TEST WITNESSED		TESTER		DATE			
		OWNER'S REPRESENTATIVE		DATE			
TEST ACCEPTED		BY		DATE			
CONDITIONS OF ACCEPTANCE: <b>SLOWLY PRESSURED LINE TO 225#</b> <b>RELAXED LINE FOR 30 MIN.</b> <b>TESTED LINE FOR 1 HR. ( WALKED LINE-NO LEAKS FOUND)</b> <b>NOTED 8# PRESSURE DROP OVER 1 HOUR</b>							
<b>LUBED AND GREASED ALL VALVES</b>							
REMARKS <b>GOOD TEST</b>							

# Certificate of Calibration

**Certificate No.:****19148**

Page 1 of 2

Date of Calibration:

10/13/2011

Customer

Herron Valve &amp; Instrument

103 Enterprise Dr  
ROYERSFORD, PA 19468**Pressure and Temperature  
Measurement**WIKA Instrument Corporation  
1000 Wiegand Boulevard  
Lawrenceville, Georgia 30043

Tel. 770-513-8200

Fax 770-338-5118

www.wika.com

info@wika.com

*FOM LINE*

Order No.

1631209 LINE 1

**Specification of the device under test**

**Object** : Dial Gauge  
**Manufacturer** : WIKA  
**Model** : 232.34 4.5"  
**Serial No.** : -  
**Tag** : -  
**Pressure range** : 0 ... 300 psi  
**Accuracy** : 0.5 % (of span )  
**Scale division / Resolution** : 2 psi  
**Method of measurement** : Gauge pressure  
**Output signal** : -

**Working Standard (WS)**

**Name** : Digital Gauge  
**Pressure range** : 0 ... 40 bar  
**Calibration-number** : 69792 12-10-2010  
**Accuracy** : 0.02 % (of span )  
**Identity** : SS 108  
**Recal Frequency** : 1 year

**Calibration parameters**

**Place of calibration** : Cal-Lab (Lawrenceville)  
**Test temperature (in °F)** : 74.5  
**Humidity (in %)** : 50.0  
**Amb. pressure (in inHg)** : 28.8  
**Pressure medium** : dry air  
**Angle position** : vertical  
**Local gravity (in m/s<sup>2</sup>)** : 9.79541

**Used auxiliary instruments**

**Multimeter** : -  
**Resistor** : -

Comments

Quality Assurance

E. Rivera

Calibration technician J. Tadic

Certificate No.:

**19148**

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**Pressure and Temperature  
Measurement**  
WIKA Instrument Corporation  
1000 Wiegand Boulevard  
Lawrenceville, Georgia 30043

Tel. 770-513-8200  
Fax 770-338-5118  
www.wika.com  
info@wika.com

**FOM LINE****Calibration results**

Reading DUT <i>psi</i>	Reading WS <i>psi</i>		Hysteresis <i>psi</i>	Deviation %	Deviation %	Pass/Fail
	<i>M 1</i>	<i>M 2</i>				
0.0	0.01	0.07	0.06	0.00	-0.02	PASS
50.0	50.35	49.91	0.44	-0.12	0.03	PASS
150.0	149.99	149.92	0.07	0.00	0.03	PASS
250.0	250.32	250.15	0.17	-0.11	-0.05	PASS
300.0	300.36	300.37	0.01	-0.12	-0.12	PASS

*Wika Tadr*

Date Entered into Service: \_\_\_\_\_ Re-Calibration Date: \_\_\_\_\_

User specified recalibration due date based upon date entered into service and the user's Quality Assurance procedures.

**Declaration of conformity:**

The device under test meets the specifications as required by the manufacturer.

**WIKA Instrument Corporation certifies that the above named instrument has been calibrated by comparison to laboratory standards traceable to the National Institute of Standards and Technology (NIST)**

**This certificate shall not be reproduced, except in full, without the written approval of Wika Instrument Corporation Calibration Laboratory**

Calibration is carried out according to the following procedures:

ISO 10012-1 Edition 15-0101992

ANSI / NCSL Z 540-1-1994

WIKAI Procedure SOP 0 2